U.S. FIELD ARTILLERY AFTER WORLD WAR I: MODERNIZING THE FORCE WHILE DOWNSIZING

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The United States entered World War I ill equipped and undertrained. In the years between the American Civil War and World War I, an isolationist strategy inhibited the United States military. This unpreparedness was particularly true of the artillery, which was of little use on the frontier. Rapid expansion, combined with outdated equipment and lack of training forced the United States to be almost completely dependent on its allies to equip and train its force during World War I. Following the war, the U.S. recognized the need to modernize its artillery organization, weapons, and tactics. It convened several boards to assess the requirements for an effective field artillery force, studying the materiel and organizations of France, Germany, Italy, the United Kingdom, and the United States. From this, the boards determined the best course to prepare for a future conflict on the scale of World War I. The War Department instituted a number of programs to improve artillery, but all of those would be hampered by funding limitations. Development of new artillery weapons was almost completely stunted. Auxiliary areas of materiel, such as ammunition, carriages, and vehicles were more successful. Organizational changes reflected the board recommendations and were adequate in supporting maneuver, but manning shortages inhibited the ability to train these organizations. The boards had formulated recommendations that would have prepared the field artillery to support the army in a future large-scale war, but these changes were not implemented effectively under the constrained budget of 1919-35.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

U.S. FIELD ARTILLERY AFTER WORLD WAR I: MODERNIZING THE FORCE WHILE DOWNSIZING, by Major Jonathon T. Palumbo, 100 pages.

The United States entered World War I ill equipped and undertrained. In the years between the American Civil War and World War I, an isolationist strategy inhibited the United States military. This unpreparedness was particularly true of the artillery, which was of little use on the frontier. Rapid expansion, combined with outdated equipment and lack of training forced the United States to be almost completely dependent on its allies to equip and train its force during World War I. Following the war, the U.S. recognized the need to modernize its artillery organization, weapons, and tactics. It convened several boards to assess the requirements for an effective field artillery force, studying the materiel and organizations of France, Germany, Italy, the United Kingdom, and the United States. From this, the boards determined the best course to prepare for a future conflict on the scale of World War I. The War Department instituted a number of programs to improve artillery, but all of those would be hampered by funding limitations. Development of new artillery weapons was almost completely stunted. Auxiliary areas of materiel, such as ammunition, carriages, and vehicles were more successful. Organizational changes reflected the board recommendations and were adequate in supporting maneuver, but manning shortages inhibited the ability to train these organizations. The boards had formulated recommendations that would have prepared the field artillery to support the army in a future large-scale war, but these changes were not implemented effectively under the constrained budget of 1919-35.

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CHAPTER 1

INTRODUCTION

Militaries are in a constant battle to innovate in response to new discoveries in technology. Technological advances enable materiel improvements, which in turn require advances in tactics and organization; however, political and social constraints, compounded by conservative military leaders, often inhibit development. As the United States military moves from a military at war to a military of preparedness, budgetary constraints make modernization more difficult. At the same time, the army has tasked the Field Artillery branch with developing cheaper forms of precision fires. With the success of precision munitions, such as Excalibur and Guided Multiple Launch Rocket System (GMLRS), a high expectation has been placed upon artillerymen. The branch must find ways to maintain this capability at a significantly reduced cost. In addition, it must find a way to retain the knowledge gained from thirteen years of war as well as train and equip its force for an uncertain future mission. Following World War I, the branch faced similar requirements for modernization under political and budgetary constraints while capturing the lessons of the war and training for an uncertain future enemy.

In the years between the American Civil War and World War I, an isolationist strategy as well as military leaders focused on subduing Native Americans on the frontier and defending the coastline from naval attacks inhibited the United States military. Field artillery suffered significantly because it was of use little on the frontier and its effectiveness during the Civil War stunted any drive for change. The Spanish-American War, where ill-equipped and under-trained field artillery units were ineffective against

Spanish forces, altered this attitude. It spurred a drive for change, but a lack of funds and industrial base meant that the U.S. could do little prior to entering World War I.

World War I forced the United States Army and its Field Artillery branch in particular to adapt quickly to the conditions of the war. Rapid expansion, combined with outdated equipment and lack of training forced the United States to be almost completely dependent on its allies to equip and train its force. It lacked the industrial base to produce artillery and was unable to develop that production capability before the end of the war. Without French and British intervention, the United States would have been incapable of providing field artillery in support of the American Expeditionary Force (A.E.F.).

Following the war, the U.S. Field Artillery recognized the need to modernize its artillery organization, weapons, and tactics. Not only did the United States have to bridge the gap between it and the artillery of other major armies, but it had to keep pace with the continued technological advances of industrialization. The United States Army recognized its need to capture the lessons of the war and modernize its weaponry, but there was little economic support for these efforts. The prevailing opinion both in the United States and internationally was that there would never again be a war on the scale of World War I. The war also spurred a strong movement toward isolationism both in the public and political leaders. Within the artillery community, traditionalists were reluctant to accept rapid changes despite the experiences of the war. The Army needed to modernize its artillery, but until 1935, it would have to do so under the same conditions of isolationism and budgetary constraints that had caused it to be unprepared for World War I.

Purpose

The purpose of this thesis is to determine if the United States Army was able to modernize its field artillery appropriately during the low budget period following World War I. After having been dependent upon the support its allies during the war, the United States convened several boards to assess the requirements for an effective field artillery force. Those boards analyzed the materiel and organizations of France, Germany, Italy, and the United Kingdom to determine the most effective artillery during the war. The boards also focused heavily on the materiel, organization, doctrine, and training of the United States leading up to and during the war. From this, they determined the best course to prepare for a future conflict on the scale of World War I. Their findings, combined with the input of key artillery leaders provided an appropriate plan for preparing the U.S. field artillery for a future large-scale war. The fifteen years following the war, however, would be a time of isolationism and small budgets similar to the prewar era. The War Department would need to find ways to modernize under difficult conditions. After 1935, the influx of New Deal funding combined with the growing threat of war in Europe and the Pacific removed the restrictive spending that had existed since the end of World War I. As this study focuses on modernization under budgetary constraints, it only looks at the post-war period up to 1935.

Evaluation Criteria

The determination of the success or failure of the United States Field Artillery branch relies upon primary source documentation and research as well as analysis by historical experts. Comparison of the recommendations of the post-war artillery boards to the actual accomplishments by 1935 will serve as the method of evaluation, focusing on

the areas of materiel, organization, doctrine, and training. Materiel will be the primary area of analysis, followed by organization, doctrine, and training, determining if the field artillery modernized in those areas in accordance with the recommendations identified in the post-war boards. Success will be defined as modification in accordance with or surpassing the boards' recommendations. The ability to incorporate technological advances enabling improvements in materiel will also be considered.

Literature Review

For a broad understanding of the history of field artillery, *The Organizational History of Field Artillery: 1775–2003* by Janice E. McKenney is an excellent source. As part of the Army Lineage Series from the Center of Military History, *The Organizational History of Field Artillery* covers the major historical events in field artillery with a particular focus on the United States Army. Janice McKenney covers the period of 1775 to 2003 in a surprising amount of detail, yet is very succinct. Dr. Boyd Dastrup's *King of Battle: a Branch History of the U.S. Army's Field Artillery* is another excellent source of artillery development, again focusing on the United States Army. Dr. Dastrup, the United States Army Field Artillery School Historian, is perhaps the most knowledgeable person on U.S. field artillery history, and he does a thorough job of detailing it in *King of Battle.*

For primary sources, the most valuable resources can be found at the Morris Swett Technical Library at Fort Sill, OK. Morris Swett Library was particularly helpful in producing unpublished military documents on field artillery, such as the post-war boards. The Combined Arms Research Library at Fort Leavenworth, KS, was also an invaluable resource for rare and unpublished documents.

The post-war board findings are essential to understanding the U.S. Army's outlook exiting the war. The “Hero Board” provides the greatest amount of information as it includes not only the board findings, but the opinions of numerous Coast and Field Artillery officers, that of the U.S. Army Expeditionary Force Chief of Artillery and the U.S. Chief of Field Artillery. The “Caliber Board” presents its findings in a very clinical and scientific manner, providing little detail of the board members' opinions.

For a broad understanding of field artillery during a particular period, two excellent primary sources are the Annual Reports of the Chief of Artillery and *The Field Artillery Journal*. The Annual Reports provide a snapshot of the major events and concerns of the Field Artillery Branch of any given year, and provide interesting insight into the thoughts of the branch chief. A researcher must be aware that the reports are in part an effort to promote the successes and the needs of the branch to Congress, and therefore must be read with a discerning eye. *The Field Artillery Journal* provides even more insight into the concerns of the Field Artillery Branch and its leaders. The journal was published tri-monthly starting in 1911 and bi-monthly starting in 1920.

Composition

This study examines the development of American artillery materiel, organization, and doctrine from the Civil War through the inter-war period. It determines if the army learned the lessons of entering World War I with an ill-equipped and undertrained artillery force dependent upon allied assistance and if it was able to implement change despite the political and budgetary constraints following the war. American artillery is the focus of this study, as it required the most innovation of all the established army disciplines.

The study begins in the period immediately prior to the Civil War because it is a period of rapid change and innovation in artillery, transitioning from direct fire smoothbore cannons to pieces containing all the components of modern artillery, including rifled tube, retractable breech, recoil mechanism, and indirect sighting mechanism. It studies the materiel, tactical, and organizational changes from 1850 to 1935. It concludes at 1935 because the military received greater budgetary support after 1935 as a result of New Deal programs and the increasing threat of war. Chapter 2 details the major artillery advancements made prior to World War I and compares them to the changes in American artillery. Chapter 3 looks at World War I and how the major combatants employed their artillery materiel, organization, and tactics, to include adaptations made during the war. Chapter 4 covers the lessons learned by the United States Army and its artillerymen with a focus on the post-war artillery boards. Chapter 5 looks at how the U.S army implemented changes to field artillery under an environment of budgetary constraint. Chapter 6 presents the study's conclusions.

CHAPTER 2

BACKGROUND

In the 1850's American artillery equipment and training were comparable to that of Europe, but by the time America entered World War I, its artillerymen were ill equipped and forced to depend upon the French and British to equip and train them. While European artillery progressed through significant technical and tactical advances from 1850 until the outset of World War I, the U.S. largely remained stagnant. This chapter will examine the advances made in artillery during the period, and the causes of American artillery's unpreparedness.

Artillery progressed through arguably the most significant technical advances of its extensive history from 1850 until the outset of World War I. The artillery that dominated the western front of the latter war included all the components of the modern cannon, including rifled tube, retractable breech, recoil mechanism, and indirect sighting mechanism, as well as ammunition with fuzed explosive projectile and smokeless propellant. Just seventy years earlier bronze, smooth-bored muzzle-loaders were the standard.

Cannon Improvements

Armies made little advancement in firepower or range from 1600 until 1850. Smoothbore cannon remained the primary artillery piece during this period.[1] Improving

[1]The Field Artillery School, *Instructional Memorandum: History of the Field Artillery School, Development of Field Artillery Materiel* (Fort Sill: The Field Artillery School, 1939), 40.

mobility was the focus of cannon designers during this time. Technology, however, would take time to catch up with the ideas.

Cannoneers were aware that rifling of artillery greatly increased the range and accuracy of a projectile, experimenting with productions as early as the 15th century.[2] All early attempts to produce a rifled cannon failed because the metallurgy of that era could not produce a cannon strong enough and durable enough to withstand the strain produced when firing a projectile through a rifled tube. It was over two hundred years before anyone successfully produced a rifled cannon. Baron Wahrendorf of Sweden and Major Cavalli of the Sardinian Artillery independently produced successful rifled cannons in 1846. Each design consisted of two grooves in the tube to impart spin.[3] Experiments with both cannons were successful. However, the durability of the breech in each of these weapons proved to be problematic.[4]

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[2]Rifling is the act of engraving spiral grooves upon the inside of the tube. A projectile made to fit precisely into the cannon tube will be engraved to correspond with the raised portions of the tube (lands). When the cannon is fired, the rifling has multiple beneficial effects. The seal created by the projectile provides an enclosed space in which pressure can build as the propellant burns. The friction created by the contact of the projectile with the tube allows greater pressure to build before the projectile begins moving. This results in more force pushing the projectile, causing it to leave the cannon tube at a greater speed. This greater speed increases achieved distance and reduces the effects of wind on the projectile. The spin imparted upon the projectile reduces the effects of air resistance, increasing achieved distance, and reduces the effects of wind, increasing accuracy. The first known production of a rifled cannon was in Russia in 1615. Alfred Mordecai, *Military Commission to Europe: 1855 and 1856* (Washington, DC: George W. Bowman, Printer, 1861), 109; Field Artillery School, *Development of Field Artillery Materiel*, 10.

[3]T. H. Owen and T. L Dames, *Elementary Lectures on Artillery Prepared for the Use of the Gentlemen Cadets of the Royal Military Academy* (Woolwich: The Royal Artillery Institute, 1861), 170-1.

[4]Mordecai, *Military Commission to Europe*, 109.

Artillerymen had experimented with breech-loading cannons as long as they had with rifling. A Russian rifled cannon produced in 1615 had a breech-loading design.[5] However, all early designs struggled to produce rearward obturation and could not withstand the shock of repeated firing.[6] The first person to solve the problem of the breech was Alfred Krupp of Prussia. He produced a rifled steel gun with a sliding wedge breech, which he showcased at the Great Exhibition in London in 1851.[7] Wilhelm I, the King of Prussia, was impressed and ordered three hundred Krupp guns, making his army the first to be equipped with steel, rifled breechloaders.[8]

Krupp was also the first to design a functional recoil mechanism. Instead of attaching the cannon directly to carriage, he created a cradle that allowed the cannon to slide backwards when fired. A system of hydraulic cylinders and springs absorbed the shock of firing and returned the tube to the pre-fire position.[9] The combination of rifled steel gun and recoil mechanism enabled the Krupp to fire far more accurately and at significantly greater distances, up to 4,000 yards compared to approximately 1500 yards

[5]Ibid.

[6]Obturation in ordnance is the condition where gases are unable to pass through a barrier. Forward obturation is achieved through the projectile mating against the tube. Rearward obturation is achieved by creating a seal between the tube and the breech. Field Artillery School, *Development of Field Artillery Materiel*, 10.

[7]Ibid., 34-5.

[8]Boyd L. Dastrup, *King of Battle: A Branch History of the U. S. Army's Field Artillery* (Fort Monroe, VA: United States Army Training and Doctrine Command, 1992), 84.

[9]Ibid., 127.

for smoothbores. The Krupp gun also fired significantly more rapidly, since the crew did not have to return it to battery manually.[10]

The Krupp cannon would prove itself in the Franco-Prussian War of 1870-71. It performed far superior to the French smoothbore, muzzle-loading Napoleon 12-pounder. Due to the Krupp's extended range, the Prussians were able to deploy their cannons centrally and mass fires throughout the battlefield. In response to the success of the Krupp gun, most European countries began equipping their armies with steel breechloaders.[11]

Failed attempts by the French to rifle their bronze cannons in 1859 due to erosion of the metal, combined with the exemplary performance of their artillery against the Austrians in 1859, caused the French to remain committed to the bronze smoothbore 12-pounder when they went to war with Prussia in 1870.[12] The superiority of the Krupp gun, however, forced the French to focus their efforts on developing modern cannon. The result was the French M1897 75-mm, the culmination of European cannon development prior to World War I. The M1897 was a rifled steel gun with a hydro-pneumatic long-recoil mechanism. The recoil system consisting of two parallel cylinders connected at the

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[10]Battery is the position in which a gun is ready to fire. Muzzle-loading guns had to be drawn back out of battery to be reloaded, then drawn back into battery to fire. A breach-loading cannon would still be forced out of battery by the force of the round firing, requiring its crew to return it to battery. A recoil mechanism absorbed most of the shock of firing, enabling the gun to remain in battery and saving significant time for the crew to reload and fire. Field Artillery School, *Development of Field Artillery Materiel*, 41; Dastrup, *King of Battle*, 126.

[11]Dastrup, *King of Battle*, 126.

[12]Field Artillery School, *Development of Field Artillery Materiel*, 39; Arthur T. Coumbe, "Combined Arms Operations in the Franco-German War of 1870-1871," *Field Artillery* (August 1968): 13.

breech. Firing forced fluid from the upper cylinder to the lower, increasing pressure and forcing the tube back into battery. The recoil mechanism, combined with a dug-in spade at the back of the frame, was so effective that the gun required little to no repositioning after firing. It had a sliding breechblock, advanced traverse and elevation mechanisms, and a panoramic sight enabling indirect lay. It was capable of firing up to thirty rounds a minute and had an effective range of 6,000 yards and a maximum range of almost 8,000 yards. Equally important, it was lightweight, allowing rapid transport over difficult terrain and enabling close support to infantry.[13]

The traverse mechanisms and panoramic sight of the M1897 were the final evolution of aiming methods for field artillery. The earliest cannons were so inaccurate that artillerists placed little effort into aiming. Gunners simply pointed their cannon toward the enemy and fired. In the 1760s, French artilleryman and innovator Jean-Baptiste Vaquette de Gribeauval was the first to develop a refined aiming system, when he introduced a screw mechanism for precise adjustment to elevation of the cannon tube and a sight mechanism that allowed for aim adjustments for distance of the target.[14] It was not until the 1880s, once cannons had effective enough recoil mechanisms to prevent damage to the sights, that artillery units began using telescopic sights.[15] At the turn of the 20th Century, panoramic sights began to become standard, enabling indirect fire by allowing the gunner to orient the sight in any direction without moving his head. The

[13]Dastrup, King of Battle, 127; Field Artillery School, *Development of Field Artillery Materiel*, 50; Janice E. McKenney, *The Organizational History of Field Artillery: 1775-2003* (Washington, DC: U.S. Army Center of Military History, 2007), 96.

[14]Dastrup, *King of Battle*, 8.

[15]McKenney, *Organizational History of Field Artillery*, 79.

French fielded the M1097 with a basic panoramic sight, and the Germans retrofitted the Krupp gun with the Goerz panoramic sight.[16]

Ordnance Improvements

Artillerymen long sought to improve the effectiveness of their projectiles by developing a means of detonation on the target. The Venetians had developed an explosive shell in 1376 by joining two hemispheres of stone or bronze with hoops and fitting the resulting projectile with a primitive fuze.[17] Lt. Henry Shrapnel of the British Army was the first to develop an effective air-bursting projectile in 1784.[18] The Shrapnel shell contained bullets, which the detonation propelled outward.[19] In 1800, Edward Charles Howard isolated fulminated mercury by dissolving mercury in nitric acid and adding ethanol, leading to the development of modern fuzes.[20] French Chemist Paul Vieille created a stable high explosive by combining picric acid with nitrocellulose (guncotton). This explosive, which the French called melinite, was packed into a cylindrical shell. When detonated, the shell splintered into rapidly propelled fragments.[21]

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[16]Dastrup, *King of Battle*, 146; Field Artillery School, *Development of Field Artillery Materiel*, 53; McKenney, *Organizational History of Field Artillery*, 96.

[17]Field Artillery School, *Development of Field Artillery Materiel*, 10.

[18]Owen and Dames, *Elementary Lectures on Artillery*, 12.

[19]Field Artillery School, *Development of Field Artillery Materiel*, 24.

[20]Edward Howard, "On a New Fulminating Mercury," *Philosophical Transactions of the Royal Society of London* 90 (1 January 1800): 204-5; *Field Artillery School, Development of Field Artillery Materiel*, 28.

[21]Dastrup, *King of Battle*, 128.

Advances in propellant paralleled those of the projectile. Armies sought a replacement for black powder, as its high burn rate caused dangerously high pressures in cannons and forced the projectile into motion too quickly, resulting in reduced range. In addition, the large amount of smoke made crew operations difficult and exposed cannon positions to the enemy. In 1865, Major Schultz of the Prussian artillery produced the first smokeless powder, but it was not a significant improvement over black powder. Vieille produced the first effective smokeless powder, when he was able to stabilize the dangerous compound nitrocellulose in 1884. This compound was used in the Russo-Turkish War of 1887-88, where it achieved improved range, penetration power, and rate of fire as well as helping conceal gun positions, improving survivability. Alfred Nobel of Sweden improved upon Vieille's breakthrough in 1887, by combining nitrocellulose with nitroglycerine, producing the first version of the modern day propellant commonly referred to as cordite.[22]

Organization and Employment

Although armies used cannon artillery on the battlefield from its inception, it was primarily limited to siege warfare due to the size and weight of early pieces. King of Sweden Gustavus Adolphus was the first to use artillery light enough to be mobile, the first true field artillery, during his campaign in 1631-32.[23] Frederick II of Prussia (1740-1786) was the next leader to make significant changes, organizing his artillery into batteries and regiments, introducing horse-drawn artillery, and positioning his artillery

[22]Field Artillery School, *Development of Field Artillery Materiel*, 48; Dastrup, *King of Battle*, 127-8; McKenney, *Organizational History of Field Artillery*, 90.

[23]Ibid., 18.

ahead of the infantry.[24] Inspired by Frederick, Grubeauval reorganized the French artillery, reducing the types of cannons in the inventory to streamline the supply system. He also restructured horse artillery into the caisson, in which the horses were hitched abreast rather than single file.[25] Napoleon Bonaparte further reorganized the French artillery into division, corps, and reserve elements.[26] The changes of Frederick, Grubeauval, and Napoleon were the model of artillery until the 1860's, when significant advances in small arms made artillery too vulnerable for aggressive employment.[27] The Prussians were able to take advantage of the extended range of the Krupp gun and employ their artillery immediately to the rear of the infantry lines, firing over their heads in support. This, however, required them to be employed on high ground, making them easy to identify and vulnerable to enemy artillery.[28]

By the 1890's, with modern artillery pieces ranging up to 8,000 yards, batteries needed cover from the enemy to protect against counterfire. The ability to engage targets through indirect fire became necessary. The first employment of indirect fire was during the Russo-Turkish War of 1877-78, where the Russians indirectly laid their coastal guns for direction.[29] In 1882, Russian officer Karl G. Guk developed an effective system of

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[24]Dastrup, *King of Battle*, 7.

[25]Field Artillery School, *Development of Field Artillery Materiel*, 24; Dastrup, *King of Battle*, 7-8; McKenney, *Organizational History of Field Artillery*, 24.

[26]Field Artillery School, *Development of Field Artillery Materiel*, 28.

[27]Ibid., 40.

[28]McKenney, *Organizational History of Field Artillery*, 82.

[29]Ibid., 96.

indirect lay with a forward observer, a compass, and an aiming point. The observer estimated range and adjusted the rounds onto the target. By the 1890's, Russia, Germany, and France were using this aiming point method for indirect fires. Even so, artillery officers preferred direct fire because it was less complicated.[30]

The Russo-Japanese War of 1904-05 convinced most artillerymen that indirect fire should be the primary method of employment. Although Japanese artillery was inferior in range, it was able to dominate the artillery battle by placing its guns in concealed positions, usually on the backwards slope of hills. In addition, the Japanese dispersed their guns to limit the damage of Russian fires. To ensure coordination between the dispersed batteries, the Japanese used telephones to direct fires. In the Battle of Nan-Shan Hill, the Russians employed the traditional, direct-fire method of placing their guns on the crests of hills. Japanese artillery quickly identified these positions and destroyed them.[31]

The Japanese use of indirect fire shifted the emphasis of gunnery skills from the gunner to the observer.[32] Communication was the primary challenge for indirect fire. The observer had to see the guns, target, and aiming point in order to direct fire missions. To ensure the accuracy of fire missions, the battery commander was usually the observer, assisted by a signal officer. Early observers used signal flags, heliographs, and when

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[30]Dastrup, *King of Battle*, 129.

[31]James D. Sizemore, "The Russo-Japanese War, Lessons Not Learned" (Thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 2003), 22, 32-3; Dastrup, *King of Battle*, 148; Field Artillery School, *Development of Field Artillery Materiel*, 99; McKenney, *Organizational History of Field Artillery*, 53-4.

[32]Sizemore, "Lessons Not Learned," 32.

available telephones to communicate. By 1912, artillery had transitioned to the telephone as the primary method of communication between observer and battery. However, wires were vulnerable, so signal flags remained in use as an alternate form of communication.[33]

American Civil War Artillery

The United States in the first half of the 19th Century modeled its artillery after post-Napoleonic French artillery. The U.S. army sent a group of officers to Europe in the 1820s to study different organizations of artillery and provide observations and recommendations to the Secretary of War. This group returned with British and French artillery writings, from which the War Department developed the first U.S. artillery doctrine, *Artillery Tactics,* in 1826.[34]

In 1855, the War Department sent American artillery officer Major Alfred Mordecai to Europe to observe and evaluate the artillery of prominent European nations. Major Mordecai completed a detailed account of experiments in rifled cannons, determining that rifling improved distance and accuracy. However, he observed that safety and reliability of rifled cannons were issues due to inadequate breeches. Mordecai recommended that the U.S. should conduct its own experiments once technology allowed for the manufacture of stronger breeches.[35] In the meantime, he recommended the artillery field a smooth-bored bronze cannon based on the artillery of Napoleon III.[36] As

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[33]Dastrup, *King of Battle*, 150-1; Field Artillery School, *Development of Field Artillery Materiel*, 97, 99.

[34]Mordecai, *Military Commission to Europe*, 56.

[35]Ibid., 109-15.

[36]Ibid., 141, 145.

a result, the United States fielded the M1857 12-pounder "Napoleon" to its light artillery batteries.[37]

The U.S. Ordnance Board met in 1860 to reevaluate rifled artillery. The board recommended that future field artillery pieces be made of cast-iron and seacoast artillery of wrought iron. However, based on the large inventory of 12-pounder Napoleons, the board recommended that the War Department convert half of the current inventory into rifled guns by reboring. This proved disastrous, as the guns could not withstand the increased pressure resulting from firing rifled projectiles.[38] As a result, 12-pounder Napoleons remained the standard piece as the army entered the Civil War.

The Union War Department did purchase 300 wrought-iron 3-inch caliber rifled guns at the beginning of the Civil War to increase the artillery inventory. These rifled guns were far more accurate and had significantly greater range; however, they failed to gain favor due to reliability issues, unfavorable battlefield conditions, and resistance to change. Integrity of the breech and a high dud rate of the rifled projectiles due to defective fuzes decreased the value of the rifled guns. The broken, wooded terrain of most Civil War battlefields negated the range advantages of the rifled guns. The terrain required that artillery provide a large volume of fire at relatively short distances and the ability to shift from explosive shell to shot and canister as the battle progressed, both of which the smoothbore could perform and the rifled could not. Artillery officers at all levels also resisted changes to rifled cannons. In a letter in March of 1864, the Chief of

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[37]Field Artillery School, *Development of Field Artillery Materiel,* 39; McKenney, *Organizational History of Field Artillery,* 49-50.

[38]Field Artillery School, *Development of Field Artillery Materiel,* 39-40.

Ordnance, Brigadier General George D. Ramsey, espoused his preference for smoothbore muzzle-loaders due to the rapidity and safety in which they could be fired. However, he provided no statistical data to support his argument.[39]

At the beginning of the Civil War, both Union and Confederate forces organized their artillery in batteries distributed to infantry regiments and controlled by the regimental commander.[40] This was the organization successfully employed during the Mexican-American War, but the increased range of rifled muskets and the increased sizes of the armies made such decentralization ineffective. At the first major battle, First Bull Run, infantrymen were able to range the artillery, causing heavy losses.[41] After this engagement, Major General George B. McClellan appointed Major William F. Barry chief of artillery. Major Barry consolidated batteries under divisional control. He was able to employ this new organization at the Battle of Seven Pines, where the massed artillery effectively engaged the attacking Confederate infantry.[42] For the rest of the Civil War both sides fought with artillery organized at the divisional level, with a general reserve employed by the battlefield commander. This effectively mirrored the Napoleonic model.[43]

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[39]Dastrup, *King of Battle*, 89, 93, 100-01, 118; Field Artillery School, *Development of Field Artillery Materiel*, 40-1, 43.

[40]McKenney, *Organizational History of Field Artillery*, 58.

[41]Dastrup, *King of Battle*, 91-2.

[42]Ibid., 92, 94-5.

[43]McKenney, *Organizational History of Field Artillery*, 58.

Table 1. Civil War Artillery

Projectile Weight	**Bore Diameter**	**Weapon Type**	**Range**
12-pounder	3.0”	Rifled Gun (wrought iron)	2,000 yards
6-pounder	3.5”	Smoothbore Gun (bronze)	600 yards (case shot)
12-pounder	4.5”	Smoothbore Gun (bronze)	700 yards (case shot) 880 yards (grape shot) 1,566 yards (solid shot)
12-pounder	4.6”	Smoothbore Gun/Howitzer “Napoleon” (bronze)	700 yards (case shot) 880 yards (grape shot) 1,566 yards (solid shot)
12-pounder	4.5”	Smoothbore Mountain Howitzer (bronze)	700 yards (case shot) 880 yards (grape shot) 1,566 yards (solid shot)
12-pounder	4.5”	Smoothbore Howitzer (bronze)	700 yards (case shot) 880 yards (grape shot) 1,566 yards (solid shot)
24-pounder	5.6”	Smoothbore Howitzer (bronze)	2,200 yards (solid shot)
32-pounder	6.2”	Smoothbore Howitzer (bronze)	2,600 yards (solid shot)

Source: Field Artillery School, *Instructional Memorandum: History of the Development of Field Artillery Materiel* (Fort Sill: The Field Artillery School, 1939), 41.

American Post Civil War Artillery

From the end of the Civil War to the Spanish-American War in 1898 American artillery suffered due to monetary constraints, conflicting American interests, and a war-weary public. The peacetime U.S. artillery shrank to five regiments, each containing one battery of 12-pounder Napoleons and one battery of 3-inch Ordnance rifles. The army stationed these batteries across the country enforcing Reconstruction, patrolling the Mexican border, and supporting the defense of western settlers against Native American

attacks.[44] Defending the settlers required a highly mobile cavalry force. As a result, field artillery batteries in the west were equipped with Gatling guns instead of cannons.[45] Artillery skills therefore atrophied. As one artillery officer observed, "much of the artillery was stationed for years at posts where there was no artillery materiel but a reveille gun. The spectacle was seen of men serving whole enlistments without seeing a cannon other than the above-mentioned field piece."[46]

Tensions with Great Britain were high at this time due to Confederate debts, a dispute over the western border with Canada, and conflicts over fishing rights in the waters off North America. As a result, the U.S. focus shifted to modernizing coast artillery. The war weary and economically strapped nation saw this as an effective means of deterrence and if necessary defense at a relatively small cost. This focus prompted significant improvements to coast artillery including steel-cast rifled breech-loading pieces, steel framed bases, and a recoil control system and sighting mechanism that enabled loading and aiming from a hidden position.[47]

Although coast artillery was the focus of modernization, the War Department did not completely neglect field artillery. The Ordnance Board of 1868 recommended testing to compare the capabilities of breechloaders and muzzleloaders. Secretary of War John M. Schofield approved the testing, but the army took no action due to lack of funding and

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[44]Dastrup, *King of Battle*, 123.

[45]McKenney, *Organizational History of Field Artillery*, 82.

[46]W. A. Simpson, "Our Artillery Organization, " *Journal of the United States Artillery* 1 (January 1892): 52.

[47]McKenney, *Organizational History of Field Artillery*, 77-8; Dastrup, *King of Battle*, 123.

the excess of smoothbore muzzleloaders from the Civil War.[48] The Ordnance Board of 1882 recommended the production of a rifled breechloader to replace the 12-pounder Napoleon. It also recommended modernizing the carriage, constructing it of steel with interchangeable wheels, road breaks, folding trail spikes, and a two-part carriage to allow movement to absorb recoil. The board further recommended converting 12-pounder Napoleons into 3.2-inch breechloaders by inserting a steel sheath inside the tube and using a round-back wedge fermeture attached by a steel strap.[49] The well-respected artilleryman William Birkhimer, upset by the Ordnance Board's influence over artillery, criticized the Ordnance Board's findings and in particular the ideas of recoil and elevating mechanisms.[50] Due to Birkhimer's influence, the U.S. decided to field the M1885, a cannon that lacked a recoil mechanism and used separate loading ammunition, making it inferior to European cannons of the late 1890s. The army also decided against using smokeless powder with the M1885 because it deteriorated rapidly when exposed to moisture.[51]

Not only was the U.S. field artillery of the late 19th Century ill equipped, but it was also poorly trained. Although the army was fielding the M1885, the production was slow. The Army's Inspector General noted in 1888 “Some of the light artillery is still plodding along with the same guns they had at the close of the war of rebellion, although

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[48]Dastrup, *King of Battle*, 125.

[49]War Department, *Report of the Board on Heavy Ordnance and Projectiles: Appointed in Conformity with the Act of Congress Approved March 3, 1881* (Washington, DC DC: Government Printing Office, 1882), 7-11, 82, 103, 142-3, 236, 260.

[50]Field Artillery School, *Development of Field Artillery Materiel*, 48.

[51] Dastrup, *King of Battle*, 134, 138.

the Prussians learned from the Austrians . . . nearly a quarter of a century ago that such guns would not meet modern requirements."[52] Training on artillery pieces was almost non-existent, as West Point instructor Peter S. Michie noted in 1887 "The Artillery are in reality Infantry, with red instead of white facings on their uniforms, and are constantly employed on infantry duty. We have no longer any artillery troops."[53]

The 1890s saw significant debate over how to organize artillery. Many artillerymen saw no reason for change in organization, citing the effectiveness of divisional artillery supported by a general reserve in the Civil War. Others called for the abandonment of the general reserve, replacing it with a corps of artillery. Observers also advocated the organization of battalions to enable a senior artilleryman to manage batteries. Regimental commanders had little control over their batteries spread across multiple posts. In the end, the advocates for change won out, with the creation of battalions of two to four batteries and the removal of the general reserve in 1896.[54]

Effects of the Spanish-American War

In 1898, the United States went to war with Spain, and quickly discovered the ineffectiveness of its artillery. By the start of the war, the War Department had fielded 100 M1885s, and when the V Corps sailed to Cuba, it brought two batteries with it. The M1885 proved incapable of providing sustained accurate fires due in large part to the lack

[52]U.S. Congress, House, *Report of the Secretary of War*, 50th Congress, 2nd session, 1888, H. Doc. 1, pt.2, 1:104

[53]Peter S. Michie, "The Personnel of the Sea-Coast Defense," *Journal of the Military Service Institution of the United States* 8 (March 1887): 8.

[54]Ibid., 134-6.

of a recoil system. The shock of firing was too great for the relatively fragile aiming mechanisms. As a result, the U.S. artillery was unable to provide support from ranges beyond the capabilities of the Spanish small arms. Even if the equipment was suitable for greater ranges, the artillerymen had no procedures for indirect fire, which they needed in the broken terrain of Cuba. Additionally, using black powder quickly revealed their positions, bringing significant counter-battery fires. The infantry and cavalry officers also complained of the artillery's black powder smoke obscuring the battlefield, making it difficult to command and control their units.[55]

The Spanish-American War forced the United States to recognize it would need a modernized artillery force to defend its territorial gains. Realizing the inadequacy of the M1885, the Ordnance Board immediately began working to replace the piece. Captain Charles B. Wheeler designed a 3-inch piece with a recoil system of hydraulic cylinders and springs that initially gained significant support; however, the gun jumped when fired, requiring the crew to re-aim it after every round. As a result, the Ordnance Board began testing a wide range of field pieces in 1901. In February 1902, the Board narrowed its search to three systems, the Bethlehem No. 2, the Ehrhardt from Germany, and the Wheeler gun. They determined the Wheeler had the best gun and carriage, but the Ehrhardt had the better recoil system. As neither fully met the requirements needed, the War Department developed the M1902, incorporating the best of the Wheeler and Ehrhardt. With a 3-inch tube, the M1902 fired a 15-pound shrapnel or explosive shell to an effective range of 6,500 yards (5,940 meters) and a maximum range of 8,000 yards

[55]McKenney, *Organizational History of Field Artillery,* 87-9; Dastrup, *King of Battle,* 131, 138-43.

(7,300 meters) at six times the rate of the M1885, making it arguably the best field gun in the world at the time.[56]

The War Department also recognized that U.S. artillerymen were woefully undertrained and underprepared for the Spanish-American War. The Army Reorganization Act of 2 February 1901 attempted to improve the capabilities of artillerymen by establishing the Artillery Corps, allowing the appointment of a Chief of Artillery to speak for the needs of U.S. artillerymen. The Act also increased field and siege batteries from 16 to 30 and coast batteries from 82 to 126.[57] General Order No. 138, issued 17 August 1905, established a three-year course at Fort Riley, Kansas, to train units on new equipment and tactics; however, shortages of manpower and ammunition as well as mission demands in the Western plains rendered the course ineffective.[58]

In 1907, Congress separated the coast and field artillery into two branches and authorized regimental organization. Prior to the separation, artillery officers would spend two-year details in a field unit while remaining permanently assigned to a coast unit. Technological improvements resulting in increased range and maneuverability forced greater tactical specialization in field artillery. Due to the rotational system in field

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[56]War Department, *Reports of the Chief of Ordnance and Board of Ordnance and Fortification, Vol. VII of Annual Reports of the War Department for the Fiscal Year Ended June 30, 1902* (Washington, DC: Government Printing Office, 1902), 9-12; War Department, *Report of the Chief of Ordnance, Vol. X of Annual Reports of the War Department for the Fiscal Year Ended June 30, 1904* (Washington, DC: Government Printing Office, 1904), 22-3; McKenney, *Organizational History of Field Artillery*, 99; Dastrup, *King of Battle*, 145-6; Field Artillery School, *Development of Field Artillery Materiel*, 52-3.

[57]George B. Davis, Judge-Advocate General, *The Military Laws of the United States,* 4th ed. (Washington, DC: Government Printing Office, 1901), 1049-51.

[58]Dastrup, *King of Battle*, 152.

artillery units, most officers understood the technical aspects of firing artillery, but lacked the ability to maneuver field artillery on the battlefield.[59] Chief of Artillery Major General Arthur Murray clearly illustrated the problem:

> It is with sound military principle that only such arms of service as have fighting or tactical relation with each other should be combined for organizational purposes. The Coast Artillery . . . constitutes in reality a passive defense force which has no tactical relation whatever with the active forces of infantry cavalry or field artillery, the three fighting elements of the mobile army. . . . The combination of the Coast and Field Artillery into a Corps as is now done is not only unsound as a military principle, but the frequent interchange of officers between these tactically unrelated arms is considered detrimental to the efficiency of both.[60]

The newly formed Field Artillery Branch organized as six regiments of two battalions, each with three four-gun batteries.[61] The branch published the Drill Regulation for Field Artillery in 1907 to assist units in training. Although it did address indirect fire techniques controlled by the battery commander or reconnaissance and signal officer, it stated the preferred method of lay was direct.[62]

In 1909, President Theodore Roosevelt, concerned about the skills of field artillerymen, sent Captain Dan T. Moore to observe training in European artillery schools. Captain Moore, upon his return in 1909, recommended the establishment of a

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[59]General Headquarters, American Expeditionary Forces (Hero Board), "Report of Hero Board; Proceedings of the Board of Officers Convened by the Following Order, General Headquarters, Army Expeditionary Forces, Office, Chief of Artillery, 1918" (Fort Sill, OK: U.S. Army Field Artillery School, Morris Swett Technical Library Division, 1919), 31.

[60]Ibid., 32.

[61]McKenney, *Organizational History of Field Artillery*, 101; Field Artillery School, *Development of Field Artillery Materiel*, 53.

[62]War Department, *Drill Regulation for Field Artillery, United States Army (Provisional) 1907* (Washington, DC: Government Printing Office, 1907), 50, 54-5, 86-7.

school to train U.S. artillerymen on the skills of gunnery and cannon operations. As a result, the War Department established the School of Fire for Field Artillery at Fort Sill, OK, in 1911, naming Captain Moore commandant of the school.[63] A lack of funding greatly hampered the School of Fire, creating shortages of men, equipment, and ammunition. In addition, most artillerymen lacked experience in firing and techniques of indirect fire, forcing training to be extremely rudimentary and resulting in officers graduating incapable of conducting battery indirect fires.[64] The School of Fire was able to revise the Drill Regulation of Field Artillery, but although the 1911 edition provided greater instructions on indirect lay, it still specified direct lay as the preferred method.[65]

Despite significant efforts to improve artillery equipment, training, and organization, U.S. artillery entered World War I woefully unprepared. The M1902 was an excellent artillery piece, but due to a lack of mass production capabilities, fielding took several years. The Ordnance Department had developed the cannon completely through its small arsenal system. It was incapable of producing cannons rapidly, and failure to take advantage of the rapidly growing American industrial base meant that no factory for gun development existed. As the Army expanded in anticipation of war, the production of cannons could not keep pace. Although the army had codified indirect fire, the lack of skilled artillerymen, funding shortages, and the bias of established artillery officers

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[63]McKenney, *Organizational History of Field Artillery*, 102; Dastrup, *King of Battle*, 153.

[64]Dastrup, *King of Battle*, 153-5.

[65]War Department, *Drill Regulation for Field Artillery, United States Army (Provisional) 1908 with changes to 1911* (Washington, DC: Government Printing Office, 1911), 79-81.

combined to prevent units from developing this ability. As a result, the American artillery force would have a difficult journey in preparing for World War I.

CHAPTER 3

THE WAR

Europe Goes to War

On July 28th, 1914, Austria-Hungary declared war on Serbia, dragging most of Europe into war, with the Central Powers of Germany, Austro-Hungary, and later Turkey and Bulgaria fighting the Allies, which included Russia, France, the United Kingdom and its Commonwealth, Serbia, Belgium, Montenegro, and later Italy, Portugal, Romania, Greece, and the United States. Japan also declared war on the Central Powers but limited its participation to seizing German possessions in the Pacific.

At the start of the war, the major belligerents had organized their artillery for the cavalry based open warfare of the previous century. A British Army infantry division included fifty-four 18-pounder (3.2-inch), eighteen 4.5-inch, and four 60-pounder (5-inch) cannons, while the German division had fifty-four 77-mm and eighteen 105-mm guns, and the French had only thirty-six 75-mm guns.[66] In the opening weeks of the war, German heavy artillery easily destroyed French and Belgian fortresses and quickly pushed allied forces to the Marne River, a mere thirty miles from Paris. The German advance forced the Allies to dig into defensive positions. Soon the front stabilized and both sides dug in. Facing the overwhelming fires of machine guns and accurate, rapid-firing artillery, both sides formed a continuous line of trenches and foxholes from the Swiss border to the North Sea.[67]

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[66]Field Artillery School, *Development of Field Artillery Materiel*, 55.

[67]Jonathan M. House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization* (Fort Leavenworth, KS: U.S. Army

To overcome the defensive advantages of trench warfare, the attacker needed overwhelming artillery superiority. As a result, artillery expenditures quickly grew. The French war plans had forecasted an expenditure of approximately 14,000 rounds per day; the actual daily expenditure was about 280,000 rounds. In addition, light artillery did not dominate the battlefield as anticipated. Instead of merely suppressing defenders, the belligerents needed greater range and power to destroy an entrenched and fortified enemy. Light field guns such as the French 75-mm fired too small of a round at too low of an angle. The French and British immediately started increasing medium and heavy artillery in their organization, a move soon matched by the Germans. The French, originally organized with only the 75-mm field gun in their division artillery, added the 155-mm howitzer. Both sides also developed railcar mounted "super guns", often adapting coast and naval guns, the greatest of which was the German Long-range Gun. The gun, of which the Germans only made nine, fired a 264-pound projectile over 75 miles. The projectile travelled so high, it passed through the upper stratosphere. Firing was so powerful that it expended the tube life after only 50 to 60 rounds. From March to August 1918, the Germans fired 367 rounds targeting Paris. The gun was so inaccurate, often varying over 15 miles between rounds, that it had no tactical or operational value; however, the Germans saw it as a valuable psychological tool.[68]

Command and General Staff College, 1984), 19-20; Field Artillery School, *Development of Field Artillery Materiel,* 56, 58.

[68]Dastrup, *King of Battle,* 168; Field Artillery School, *Development of Field Artillery Materiel*, 58-60, 62-6.

Table 2. French Artillery of World War I

	Number of Pieces		Max Range (Yards)	
Type	**1914**	**1918**	**1914**	**1918**
75-mm gun	3,840	5,490	6,000	11,000
Medium/Heavy Artillery	308	5,000	6,500/10,700	13,000/21,000
Rail & Siege Artillery	0	711	N/A	30,000-40,000
Anti-Air Artillery	1	404	N/A	N/A
Trench Artillery	0	1,680	N/A	1,590-2,265

Source: The Field Artillery School, *Instructional Memorandum: History of the Development of Field Artillery Materiel* (Fort Sill: The Field Artillery School, 1939), 56.

The warring nations made numerous other innovations during the war. In 1915, the German began using chemical shells in their artillery attacks. Smoke shells soon followed, employed on a regular basis after 1916.[69] Motor transportation began to supplant the horse as the primary mode of transportation. The tremendous increase in artillery combined with a lack of forage, soldiers inexperienced with horses, and vulnerability to enemy artillery fire, particularly gas, made the horse an unreliable source of artillery transport. Artillery units used many forms of motorized transport, but tractors were preferred due to their ability to traverse broken terrain.[70] The airplane, with its ability to observe and photograph enemy positions greatly improved artillery lethality. As

[69]Field Artillery School, *Development of Field Artillery Materiel*,59.

[70]McKenney, *Organizational History of Field Artillery*, 114-5; Field Artillery School, *Development of Field Artillery Materiel*, 60.

a result, camouflage and cover increased in importance, and a new form of artillery, the anti-aircraft gun, was developed.[71] In 1914, the French developed sound ranging, the technique of measuring distance by comparing the time between seeing a muzzle flash and hearing the firing.[72] With the close in fighting of trenches that were sometimes as little as fifty meters apart, the accuracy of artillery was critical. The British worked to improve their accuracy throughout the war developing muzzle velocity and ammunition management.[73] Seeking an indirect fire weapon that was light enough to accompany the infantry and that fired at a high angle to descend into trenches, the Germans developed a trench mortar. In 1915, English engineer Wilfred Stokes developed a 3-inch smooth-bored muzzle-loading mortar, which was the first modern infantry mortar.[74]

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[71]Field Artillery School, *Development of Field Artillery Materiel,* 59-60.

[72]Dave Wellons, "Direct Fire to Indirect Fire: Changing Artillery for the Future?" (Monograph, School of Advanced Military Studies, Fort Leavenworth, KS, 2000), 16-7.

[73]Muzzle velocity management is the determination of the effects on muzzle velocity, or the speed in which the projectile is travelling as it leaves the muzzle of the cannon tube, cause by wear on the cannon tube. As a projectile is fired, the friction of the projectile on the cannon tube wears it down, causing the diameter of the tube to increase over time. This wear reduces the amount of pressure needed to start the projectile in motion and allows gasses to escape around the projectile. Both of these cause a reduction in muzzle velocity, thereby a reduction in the range the projectile travels. Ammunition management is the determination on the effects of muzzle velocity caused by slight variations in projectile weight and the burn rate of the propellant. A heavier projectile typically travels a shorter distance with the same charge from the same tube. Propellants, dependent upon the precise mixture of ingredients will burn at different rates. A faster burning propellant will cause the pressure to increase higher before the projectile begins moving, thereby increasing achieved range. Projectiles and propellants will vary dependent upon where and when they are manufactured. Projectiles and propellants made in a common location, with common ingredients are assigned a "lot number" that allows them to be identified and tracked. The British began segregating their ammunition by lot number and only firing a single lot in missions after they had registered it. Dastrup, *King of Battle,* 151.

[74]House, *Toward Combined Arms Warfare,* 32.

As artillery increased in range and accuracy, developing an accurate and efficient system for indirect fire became important. Artillery units needed observers to travel with or immediately behind the infantry to provide target locations to the guns. Telephone had become the preferred method of communications on the battlefield, but artillery fire easily severed telephone wire, and telephone communications were not practical in offensive operations, when directing artillery fire to prevent fratricide was critical. Radios had entered the battlefield, but they were bulky, unreliable, and susceptible to enemy intercept. Both the Germans and the Allies attempted various forms of signaling, signal flags, paddles, signal lamps, colored smoke grenades, and flares. The French even went to the extreme during the Champagne campaign of 1915 of sewing white material on the back of soldiers' uniforms to help track their progress. Despite these efforts, accurate targeting remained an issue on the smoke-filled battlefield.[75]

Two techniques developed to overcome the difficulties in accurate, timely observation of fires were map spotting and rolling barrages. Map spotting used the identification of enemy positions from aerial observers and other intelligence to plot the targets on a map. Staffs would normally identify and plan targets in the days before an attack. The rolling barrage was the technique of assigning each weapon a portion of the front, and shifting its fires deeper into the enemy positions at predetermined intervals. With all the guns synchronized, this created a wall of explosives and smoke, which the infantry could follow. The rolling barrage often failed to meet its intent because the

[75]Dastrup, *King of Battle*, 161-2; House, *Toward Combined Arms Warfare*, 21.

infantry slowed and the enemy soon learned to withdraw its troops until after the barrage passed, then reoccupy afterwards.[76]

America Prepares for War

As Europe became entrenched in war, the United States did not stand still. Based on reports returning from the war, it was clear that indirect fire would be the primary method of artillery fire of the future. As a result, the War Department updated doctrine, publishing the *Provisional Drill and Service Regulations for Field Artillery (Horse and Light) 1916*, which detailed indirect fire tactics for offensive and defensive operations. It prescribed that both on the offensive and defense, artillery should fire upon hostile artillery until its infantry came within small arms range, then shift to the enemy infantry.[77] In 1917, American observers of the war published *General Notes on the Use of Artillery*, containing their observations on the war and the British and French artillery doctrine.[78] *General Notes* focused on the technical aspects of artillery on the Western Front, detailing counter-battery fires as well as fires upon railways, villages, and enemy works, such as trenches, wire, and fortifications. It outlined the priorities of offensive fires as counter-battery, fires accompanying infantry movement, and covering fires or

[76]Dastrup, *King of Battle*, 175-6; House, *Toward Combined Arms Warfare*, 21-2.

[77]War Department, *Provisional Drill and Service Regulations for Field Artillery (Horse and Light) 1916* (Washington, DC: Government Printing Office, 1917), 111-5.

[78]Wellons, "Direct Fire to Indirect Fire," 14.

rolling barrages. Defensive fires priorities were counter-preparations, or massed fires on enemy positions, and barrages against attacking infantry.[79]

In May 1916, with increasing likelihood of the U.S. entering the war in Europe, the U.S. Congress passed the National Defense Act, significantly increasing the size of the Regular Army and National Guard as well as establishing the Reserve Officers' Training Corps. The army increased from 108,000 to 175,000 with an authorization of 285,000 during war. Regular Army Field Artillery increased from six to nine regiments with an authorization of twenty-one in war. The National Guard artillery expanded to the equivalent of twelve regiments and an organized reserve regiment was established. In order to meet this expansion, the army split three of the four light artillery regiments in half, with the other light regiment stationed in detachments in American colonies.[80]

The U.S. entered World War I in April 1917, expanding the Regular Army artillery yet again to 21 regiments, creating the National Army with 138 regiments, and increasing the National Guard to 51 regiments. All of these units expanded from the nine Regular Army and twelve National Guard regiments already depleted by the 1916 expansion, severely diluting the experienced artillerymen. At that time, as Major General William Snow, Chief of Field Artillery explained:

> Peace strength regiments, which had been split in half in 1916, were again divided into three parts in June 1917. . . . The entire enlisted personnel contained in the original six regiments on June 30, 1916, was not sufficient to supply even the noncommissioned officers required for the 21 regiments in existence in June

[79]War Department, *General Notes on the Use of Artillery*, translated and edited at the Army War College (Washington, DC: Government Printing Office, 1917), 14-20.

[80]War Department, *Annual Reports, 1919, Vol. I, Part 4* (Washington, DC: Government Printing Office, 1920), 5051-2; Dastrup, *King of Battle*, 161, 163; McKenney, *Organizational History of Field Artillery*, 109.

1917. Moreover, approximately 400 of the best noncommissioned officers had been sent to officers' training camps and had received temporary commissions after the outbreak of war. . . . Noncommissioned officers in the higher grades, such as sergeants major, color sergeants, regimental supply sergeants, first sergeants, etc., were, for the most part, men who had been corporals in the original six regiments a year before. . . . Later this situation was aggravated by the transfer of some 800 noncommissioned officers to the National Army Field Artillery for training purposes.[81]

Table 3. Commissioned Officers at Outbreak of War

	Colonel	**Lieutenant Colonel**	**Major**	**Captain**	**Lieutenant**	**Total**
Duty with Troops	9	8	15	92	129	**253**
General Staff	1	-	1	1	-	**3**
AG Office	-	2	-	-	-	**2**
IG Office	-	-	3	-	-	**3**
Quartermaster	-	1	1	10	-	**12**
Ordnance	-	1	-	3	13	**17**
Signal	-	-	-	1	4	**5**
Militia Bureau	-	1	-	11	2	**14**
Instructor, USMA	-	-	-	3	6	**9**
Recruiting Service	1	-	-	3	4	**8**
Student, Fort Leavenworth	-	-	-	-	46	**46**
Miscellaneous	3	1	2	6	24	**36**
Total	**14**	**14**	**22**	**130**	**228**	***408***

Source: War Department, *War Department, Annual Reports, 1919, Vol. I, Part 4* (Washington, DC: Government Printing Office, 1920), 5062.

National Guard expansion at the beginning of the war was equally taxing, expanding to over six times the starting size. On paper, the National Guard had a strong, experienced pool on which to build, with many batteries having participated in the

[81]War Department, *Annual Reports, 1919*, 5070.

Mexican border mobilization; however, many of these units reorganized, and many of the experienced soldiers had left the guard.[82] The National Army had the biggest challenge. The War Department intended that the recently created reserve force be the foundation of the National Army, but the total reserve strength of artillerymen at the start of the war was 221 officers and 33 enlisted men. From that strength, the National Army would need to grow to over 70,000 artillerymen. To help organize and train the National Army regiments, they were detailed one colonel, one field-grade officer, and one captain, as well as four senior noncommissioned officers temporarily commissioned as captains from the Regular Army.[83]

The field artillery organization for the war was three regiments for each infantry division. To better support the divisions, the War Department organized a field artillery brigade for each division to manage its three regiments, further straining the supply of experienced officers. In order to fill the new leadership positions, many officers received temporary promotions, with captains promoted to as high as brigadier general, and lieutenants as high as colonel.[84]

[82]Ibid., 5051-2, 5080-3.

[83]Ibid., 5051-2, 5072.

[84]Ibid., 5052, 5072.

Table 4. Temporary Ranks of Artillery Officers in the War

Permanent Rank		Temporary Rank						
Rank	**#**	**General**	**Major General**	**Brigadier General**	**Colonel**	**Lieutenant Colonel**	**Major**	**Captain**
Colonel	14	1	9	3	1			
Lieutenant Colonel	14		2	8	4			
Major	20			6	13	1		
Captain	118			21	72	23	2	
Lieutenant	109				10	63	34	2

Source: War Department, *War Department, Annual Reports, 1919, Vol. I, Part 4* (Washington, DC: Government Printing Office, 1920), 5063-4.

The War Department's plan for training this drastically expanded army was to organize the divisions in camps and have them train together until they were prepared to travel to Europe. These division camps, however, proved to be completely inadequate at training the field artillery units. The individual brigades lacked experienced officers to provide instruction and equipment on which to instruct. In an attempt to help with the problem, the War Department sent then Colonel William Snow to reopen the School of Fire for Field Artillery at Fort Sill, Oklahoma, it having closed just the previous year. However, this measure could do little to overcome the tremendous inexperience of the field artillery force. The School of Fire could only train 30 officers at a time due to its small size and manning.[85]

With the rapid expansion, the War Department also had to figure out how to equip the regiments. The army spread existing cannons across the divisional camps to allow

[85]Edward M. Coffman, *The War to End All Wars: The American Military Experience in World War I* (Lexington, KY: The University Press of Kentucky, 1998), 58, 66; Dastrup, *King of Battle,* 163-4; War Department, *Annual Reports, 1919,* 5054, 5150-1.

training, but as a result, most brigades had only one to four guns for training. Shortages of radios, telephones, and computational equipment also presented significant issues. Many brigades created mock guns out of logs and wagon wheels just to provide their crewmembers the most rudimentary training. Major General Snow, in assessing the camps, said "The valiant efforts of regimental officers to relieve the situation by manufacturing 'home-made' stage ordnance of wood is to be highly commended, but was almost pathetic."[86]

Late in 1917, Colonel Starbird of the Inspector General's Office inspected the Regular Army and National Guard brigades. His findings were not good. In his evaluation of the Regular Army brigades, Colonel Starbird found that conduct of fire was fair to very poor, fire discipline was good to very poor, occupation of position was good to very poor, and rate of fire for all brigades was very slow. He stated, "The inspection shows that intensive training of these regiments is necessary for several months, beginning with elementary training, before they can be regarded as effective." His assessment of the National Guard regiments was even worse. He found that "The condition of the Field Artillery of the National Guard is deplorable. . . . The most serious condition existing in the Field Artillery brigades of the National Guard is the progress of training. In only four brigades is anything like intensive training going on."[87]

With the failures of the divisional camps to prepare their artillery, the Secretary of War appointed Major General Snow as Chief of Artillery on February 1, 1918, and tasked him to develop a plan to train the field artillery force for war. General Snow immediately

[86]War Department, *Annual Reports, 1919*, 5102, 5194.

[87]Ibid., 5098, 5116.

implemented several changes with the approval of the War Department. First, he established field artillery replacement depots at Camp Jackson, SC, and Camp Zachary Taylor, KY. The War Department repeatedly pulled National Army draftees from their units to fill the shortages of the Regular Army and National Guard. General Snow established these camps to provide a training center for replacements, thus protecting the National Army units. In total, the camps trained 8,220 officers and 35,369 enlisted. General Snow also organized brigade firing centers to provide consolidated locations in which an entire brigade could train and created an organization of inspector-instructors to train and certify the brigades.[88]

Next, General Snow organized the Field Artillery Officers' Training School (F.A.C.O.T.S.) at Camp Zachary Taylor. With regiments that often had only a couple of experienced officers, a training facility was needed that could give new officers a foundation in artillery. F.A.C.O.T.S. graduated 8,735 officers between August 16, 1918, and February 1, 1919. To further this, General Snow also reorganized and expanded the School of Fire, creating a twelve-week course for 100 officers starting every week. Later, the course would expand to 200 officers in each class. Greatly aiding in the training of officers was the Reserve Officers' Training Corps (ROTC), established under the National Defense Act of 1916. Graduates of ROTC were the most motivated and quickest

[88]McKenney, *Organizational History of Field Artillery*, 117-8; *War Department, Annual Reports, 1919*, 5053-5, 5119-20.

learners in F.A.C.O.T.S. and the School of Fire, enhancing the performance of the other students.[89]

Understanding that modern artillery needed many specialty skills, General Snow established specialty officer and enlisted schools for staff, aerial observer, liaison, radio, telephones, motors and tractors, and orientation. The Draft Board placed drafted men into duties that complemented the skills developed in their vocations, but not understanding the needs of field artillery, the board assigned them blacksmiths and teamsters. Men that would have been useful to field artillery, such as drafters and surveyors as well as those experienced with radios or telephones, were sent to engineer and signal units. As a result, approximately sixty-two percent of enlisted artillery soldiers required some type of specialty training. The brigade firing centers conducted training in telephone, liaison, and orienting. French officers initially conducted staff training, but veterans returning from Europe eventually replaced them. Initially, aerial observers were part of the field artillery and trained at Fort Sill, but later the Air Service assumed responsibility for them. This caused disconnects between observers and the guns on the ground. Fort Sill established a seven-week course to familiarize aerial observers with artillery tactics and firing to improve their ability to support artillery. Radio training was initially a ten-week course conducted by the Signal Corps at College Park, MD, but later switched to a three-week course at the Air Service Radio School at Columbia University, New York. The Ordnance Department conducted a twenty-eight day motor and tractor specialist course in

[89]Raymond Walters, "Field Artillery in American Colleges," *The Field Artillery Journal* 9, no. 5(November-December 1919): 545; McKenney, *Organizational History of Field Artillery*, 117-8; *War Department, Annual Reports, 1919*, 5053-5, 5119-20.

Raritan, NJ. It could not meet the demands, so the brigade firing centers assumed the training.[90]

Finally, General Snow worked closely with the Ordnance Department on materiel production and developed a materiel distribution system. Having an effect on the shortages of materiel, however, proved significantly more difficult for General Snow. He wanted to increase production of the 3-inch (76.2mm) M1902 gun. The Ordnance Department, hoping to simplify ammunition supply, instead decided to produce a 75-mm gun based on the experimental Model 1916. The M1916 had many issues that were unresolved, making its production and use difficult. The Ordnance Department also contracted the Bethlehem Steel Corporation to produce a 75-mm gun based on their design of the British 18-pounder. The resulting gun, the M1917, was slow to produce due to frequent design changes and defects. The M1916 and M1917 had so many problems that the Ordnance Department abandoned them in February 1918, and began producing a gun based on the French 75-mm. This, however, also proved problematic as the French did not want to share the design of the 75-mm, considering it a vital national secret. As a result, the Ordnance Department did not produce a single light gun that reached the war front before the Armistice was signed. Sadly, the 3-inch M1902 would have served perfectly, as it proved in the spring of 1918, when it outperformed the "French 75" in testing. Fortunately, the United States made an agreement with France to supply the A.E.F. with guns and howitzers in exchange for raw materials. The French supplied the

[90]McKenney, *Organizational History of Field Artillery,* 117-8; War Department, *Annual Reports, 1919*, 5053-5, 5114, 5121-2.

A.E.F. with 862 75-mm guns, 233 155-mm guns, 796 155-mm howitzers, and 237 trench mortars, as well as accompanying artillery materiel and ammunition.[91]

Although the sweeping changes made by General Snow had significant effects, they could not remedy all the problems. The collapse of Russia on the Eastern Front added pressure, as the Allies began to press for relief as soon as possible. Officers commissioned and trained through the replacement camps, F.A.C.O.T.S., and the School of Fire were eager and capable, but time was not available to train beyond rudimentary drill and firing. In addition, shortages of materiel continued to plaque the regiments. As a result, the French established six artillery training camps, where they equipped and trained arriving units. The typical camp conducted live-fire in the mornings and classroom instruction and maintenance in the afternoons. While the soldiers trained at the camps, the French sent American staff officers to their artillery headquarters to observe planning and mission execution. Once trained, a brigade went to a quiet part of the front, where a French unit showed it daily operations.[92]

The American Expeditionary Force in Europe

In June of 1917, the First Division of the American Expeditionary Force arrived in Europe. The A.E.F., under the command of General John J. Pershing, would continue to amass forces until the signing of the Armistice in November 1918. As General

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[91]Coffman, *War to End All Wars*, 40-1; Dastrup, *King of Battle*, 164-5; McKenney, *Organizational History of Field Artillery*, 116.

[92]C. A. Baehr, "Some Notes on the Training of Emergency Officers, " *The Field Artillery Journal* 9, no. 5 (November-December 1919): 534-5; George LeR. Irwin, "Notes on the Training and Handling of Divisional Artillery in France, " *The Field Artillery Journal* 9, no. 5 (November-December 1919): 489-90, 494; Dastrup, *King of Battle*, 163-4; War Department, *Annual Reports, 1919*, 5114.

Pershing and his staff assembled and organized, Secretary of War Newton D. Baker directed Colonel Chauncey Baker to head a mission to Europe to observe organization, equipment, training, transportation, operations, supply, and administration of allied forces. Not wanting conflicting messages to reach the War Department from Europe, General Pershing ordered his staff to meet with Colonel Baker to determine a plan for the A.E.F. The group, known as the Baker Board, disagreed on artillery organization. The majority of the board believed that the organization of three regiments under one brigade in support of a division sufficed. Colonel Charles P. Summerall, Commander of the 1st Field Artillery Brigade, disagreed, believing that the A.E.F. would need an unprecedented number of guns in order to break the deadlock on the Western Front. General Pershing, listening to both sides, decided the current organization was appropriate.[93]

After several months of training, the A.E.F.'s First Division headed to the front in January 1918, assigned a quiet sector along one side of the St. Mihiel Salient. Since 1914, both sides had used this sector to send weary divisions to recuperate. The eager Americans quickly worked to escalate this sector. The artillery contributed the most to this escalation, firing over 1,000 rounds per day in February and almost 3,000 rounds per day in March. The Germans responded by firing over 800 rounds per day in February and over 1,300 per day in March.[94]

On May 28, the Americans conducted their first attack of the war at the Battle of Cantigny on the Somme River. Wanting to ensure success, the division supported the

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[93]McKenney, *Organizational History of Field Artillery*, 111-2; Coffman, *War to End All Wars*, 128.

[94]Coffman, *War to End All Wars*, 144-5.

regimental attack with its entire artillery and machine-gun battalions, the other regiments' machine-gun companies, an engineer company, and two additional rifle companies. The French provided additional artillery, tanks, flame-throwers, and air cover. The infantry was able to rehearse before the attack with the tanks and aircraft. The attack began with 386 guns and mortars firing high explosives and gas for one hour, followed by the infantry advancing behind a rolling barrage and smoke screen. Less than two hours after the artillery fired the first volley, the infantry reached its objective, an advance of 1,600 meters.[95]

In September, the American Force, consolidated under General Pershing as the First Army, prepared for an attack of the St. Mihiel Salient. As they prepared, the command debated heatedly over how much artillery preparatory fire to use. Many argued for little to no preparatory fire in order to ensure surprise, while others argued that they needed massive fires to neutralize strong points and break wire. British and French preceded their attacks by ever-increasing bombardments over the course of the war, sometimes lasting several days. The Germans, under artilleryman Colonel Georg Bruchmüller, had developed a system of short bombardment of two to three hours designed to disrupt rather than destroy the defenses. Pershing, after listening to both arguments initially decided on no preparatory fires, but later reconsidered his decision and ordered a four-hour preparatory barrage. At 1 AM on September 12, over 3,000 cannons began their barrage. Once the infantry attacked, the artillery fired a rolling barrage that shifted 100 meters every four minutes. Starting with this attack, the A.E.F. artillery used an organization for attack that they maintained for the remainder of the war.

[95]Ibid., 156.

The division artillery, composed of two regiments of 75-mm guns, one regiment of 155-mm howitzers, and one battery of 58-mm trench mortars, would conduct the rolling barrage. The corps artillery, composed of two regiments of 155-mm howitzers and one battalion of 240-mm trench mortars, would suppress the enemy artillery and provide reinforcing fires upon request. The Army Artillery, a brigade of two regiments containing 6-inch, 8-inch, and 9.2-inch cannons, remained in reserve. Additional units, consisting of four brigades of 155-mm howitzers, two brigades of heavy 8-inch and 9.2-inch howitzers, five regiments of 75-mm guns, and two brigades of rail-mounted super-heavy artillery, formed during the course of the war, acting as additional reserve and reinforcing elements. Coast artillery operated the heavy artillery and super guns, as field artillerymen had little experience with large calibers, and coast artillery had no other mission for the war. As anti-aircraft artillery developed, coast artillery would also assume that mission.[96]

The final major operation for the A.E.F. was the Meuse-Argonne Offensive. On September 25, at 1130 PM, army artillery started firing on German rear areas to begin the offensive that would end the German resistance. The army cannons bombarded the rear area with high explosives, gas, and phosphorus for six hours. At 2:30 AM, over 2700 divisional guns and howitzers began three hours of preparatory fires on the German front. At 5:30 AM, the infantry attack began behind a rolling barrage. Infantry-artillery coordination was problematic throughout the initial days of the offensive. Artillery brigades had continually shifted around the battlefield in order to mass fires, preventing them from developing experience firing for any one division. In addition, it was difficult

[96]McKenney, *Organizational History of Field Artillery*, 113-6; Coffman, *War to End All Wars*, 272-9; Dastrup, *King of Battle*, 167; Field Artillery School, *Development of Field Artillery Materiel*, 60-1.

for the artillery, particularly the heavy cannons, to keep up with the extended advance of the infantry. Supply convoys and movement of the wounded congested the narrow, often damaged roads, which the artillery needed for their advance. To mitigate this issue, the A.E.F. tried attaching batteries directly to infantry brigades in support of the attacks. The infantry favored this practice, as it allowed the troops to target machine gun nests and strong points, but the artillery disapproved due to the lost ability to mass fires and the vulnerability of the guns. After two stalls, the offensive resumed on November 1. Several days of sustained fires from 14-inch naval guns mounted on rail cars, hurling 1,400-pound projectiles into the German positions, preceded this last offensive. During the last two days of October, III Corps's artillery fired 41.4 tons of gas, eliminating nine of the twelve German batteries in its sector. By this time, gas was the preferred method of attack for counter-battery fires. With gas, artillerymen could neutralize enemy artillery in two to four hours compared to several days with high explosive shells. I Corps, however, chose not to fire gas at the German artillery, resulting in stiffer defense within its sector. Despite this resistance, the First Army was able to complete a substantial advance that day, sending the Germans on a massed retreat that would continue until the signing of the Armistice on November 11.[97]

Firepower played a decisive role in ending World War I. By 1918, the ratio of cannons to rifles had grown to 10 to 1,000; double that of the start of the war. The Allies produced almost 2,000,000 rounds of artillery per month over the course of the war. In the final year of the war, the Allies expended 160,615,000 rounds of artillery. In addition,

[97]Dastrup, *King of Battle*, 162, 171-2; Coffman, *War to End All Wars*, 300-7, 343-6; Charles E. Heller, *Chemical Warfare in World War I: The American Experience, 1917-1918* (Fort Leavenworth, KS: Combat Studies Institute, 1981), 7-11, 18-9, 86.

the size of artillery continually grew, with heavier guns and howitzers increasingly favored. Although the machine gun was the most feared weapon by the infantry, between seventy and eighty-five percent of casualties resulted from artillery fire. The U.S. Army would struggle to man, train, and equip its artillery force, but it managed to meet the needs of the war.[98] As Brigadier General George LeR. Irwin eloquently stated, "That the artillery, from its small beginning, was able to accomplish what it did is extraordinary, and, in many respects, one of the most wonderful accomplishments of the many marvelous things done by the United States during the war." Could the U.S. now capture the lessons of this war to build a modern, effective artillery force at home?[99]

[98]Field Artillery School, *Development of Field Artillery Materiel*, 61-3.

[99]Field Artillery School, *Development of Field Artillery Materiel,* 61-3; Irwin, "Notes on the Handling and Training of Divisional Artillery," 507.

CHAPTER 4

LESSONS LEARNED

Although the United States Army conducted itself honorably, the mobilization and employment of the army nearly proved disastrous. Without significant aid from the French and British, mobilization could not have occurred. This was especially true of the technical and heavily equipped artillery. Artillerymen only managed to provide a minimally trained force equipped with French and British weapons and equipment. Realizing the unsatisfactory nature of the mobilization, the American Expeditionary Force, the Field Artillery branch, and the War Department quickly worked to capture lessons learned, primarily through the convening of boards.

Three major boards consisting of veteran officers of the A.E.F. met shortly after the Armistice was signed to capture the lessons of the war and make recommendations for the future of U.S. artillery. The first panel of officers, commonly known as the "Hero Board" after its chair, Brigadier General Andrew Hero, convened on December 9, 1918 to study the experiences of the Artillery branch serving in the A.E.F. The board met with division, brigade, and regimental commanders, as well as brigade staff officers, and surveyed senior officers they were unable to meet with. Brigadier General William I. Westerville chaired the second board, known as the "Trench Mortar Board," in December 1918 to identify the best forms of indirect fire to be employed with infantry units. The third board, also chaired by Brigadier General Westervelt, convened on January 12, 1919, to study the armament, calibers, materiel, ammunition, and transport vehicles of the Field Artillery. The board, commonly referred to as the "Caliber Board," met with senior officers and artillery headquarters of all Allied armies and visited manufacturing plants in

France, Great Britain, and Italy. In addition, a board chaired by Major General William Lassiter convened on June 11, 1919 to test tractor-drawn artillery. The recommendations of these boards, along with those of Major General Ernest Hinds, Chief of Artillery, A.E.F., and Major General William J. Snow, Chief of Field Artillery, shaped the path of artillery following the war.[100]

Manufacturing

One lesson clearly learned from the war was that the army needed a large reserve of cannons to equip the force in case of another major war. Facilities for the production of cannons were virtually non-existent at the beginning of the war. They had to be created from the ground up. Although the U.S. had enough cannons to equip its initial five regiments, as the army grew, there was no capability to equip the new units. In addition, no large-scale ammunition manufacturing capability existed. The Hero Board, the Caliber Board, and the artillery leadership concurred that the army would need a reserve of ordnance in the future. Major General Hinds spoke for all when he said, "It is indispensible that an adequate reserve of materiel and equipment, particularly of ordnance, for our needs upon the outbreak of war be accumulated and maintained in time

[100]"Hero Board, " 1-2; Chief of Artillery, American Expeditionary Force (Trench Mortar Board), "Report of a Board of Officers Appointed to Make a Study of the Experience Gained by the Artillery of the A.E.F. and to Submit Recommendations Based Thereon" (Fort Sill, OK: U.S. Army Field Artillery School, Morris Swett Technical Library Division, 1919), 1-2; Chief of Staff, War Department (Caliber Board), "Report of a Board of Officers Convened to Make a Study of the Armament and Types of Artillery Materiel to be Assigned to Field Army" (Fort Sill, OK: U.S. Army Field Artillery School, Morris Swett Technical Library Division, 1919), 1-2; Headquarters, Third Army, American Expeditionary Forces (Lassiter Board), "Report of a Board of Officers Convened in Accordance with the Following Order: 50 No. 162, HQ Third Army, AEF, 11 June 1919" (Fort Sill, OK: U.S. Army Field Artillery School, Morris Swett Technical Library Division, 1919), 1.

of peace." The boards correctly captured the need to have either a large reserve of weapons or a large manufacturing system established to build weapons rapidly in a time of need.[101]

Organization

All agreed on the basic organization of artillery as well, but there were some important differences. During the war, the A.E.F. organized artillery to support divisions, corps, and an army reserve. Divisional artillery organized into a brigade containing two 75-mm gun and one 120-mm howitzer regiments. The corps artillery consisted of a brigade of three regiments as well, one 4.7-inch gun, one 6-inch gun, and one 155-mm howitzer. The army artillery was a brigade of two regiments of either 6-inch, 8-inch, or 9.2-inch cannons, dependent upon availability. The Army artillery also controlled an assortment of large caliber weapons mounted on train cars. Due to shortages in field artillerymen, the lack of a primary mission, and familiarity with heavy ordnances, coast artillerymen operated the Army Artillery. The Hero Board found that this organization had functioned very well during the war, and only recommended one change, that the Army Artillery transition to a reserve role, available for the senior battlefield commander to employ where he desired massing of fires. General Hinds recommended two changes. He believed the Coast Artillery should return to its traditional responsibility of defending the coasts, with Field Artillery assuming all mobile artillery. He agreed with the Hero Board that heavy artillery consolidate as a general reserve in place of the army artillery, but also recommended that the field army maintain an artillery staff level to advise the

[101]War Department, *Annual Reports, 1919,* 5220-1; Hero Board, 25.

commander. The organization of artillery assigned to divisions and corps as well as a reserve under the senior headquarters of the theatre provided the proper amount of support to divisions and corps while enabling the theatre commander to surge artillery where needed.[102]

Infantry Accompaniment

There was much debate over how to provide infantry regiments with immediate artillery support. The infantry needed guns that could destroy fortified positions and machine-gun nests. During the war, the A.E.F. experimented with assigning 75-mm gun batteries to accompany infantry units during advances. This proved ineffective, as the enemy quickly identified and placed fires upon the guns. In addition, many infantry commanders did not understand how to employ the guns effectively. The Hero Board recommended using mountain artillery to accompany the infantry, as it had greater mobility than the field 75-mm gun. Major General Snow believed this capability was important, but that the artillery lacked a weapon suitable for the mission and recommended further study to determine an acceptable piece. Major General Hines was of the opinion that the tank would fulfill the direct fire support role for the infantry and therefore no artillery was necessary. The boards failed to identify the increasing role of the tank in future battles, an understandable bias considering the many problems of the prototype tanks of World War I. A greater failure of the boards was to identify the role of

[102]Hero Board, 3-9, 31-3, 35.

mortars as an accompanying weapon of the infantry. The light weight and high rate of fire made the mortar an ideal accompanying weapon.[103]

Materiel

The Caliber Board made detailed recommendations of the ideal artillery pieces to field at all levels and what was practical to use until the ideal weapons were developed. To determine the proper weapons, the board examined the missions and capabilities of artillery at different echelons and reviewed the artillery available to determine what best met the requirements at each level.

Division artillery needed mobility to keep pace with the infantry, a high rate of fire, and significant range capabilities. Its primary mission was killing enemy infantry. Some countries came out of the war believing a hybrid gun/howitzer firing a 30-pound projectile, approximately double the weight used with the 75-mm field gun, was the ideal solution. The Caliber Board believed this would too greatly complicate ammunition supply and decrease mobility. The board recommended use of a light gun and a light howitzer within the division artillery. It determined the ideal light field gun to be approximately 3-inch caliber with ranges in excess of 11,000 yards, 80-degree elevation, 360-degree traverse, and a rate of fire of 20 rounds per minute. The ideal light howitzer should have a caliber around 105-mm with a max range of 12,000 yards, 65-degree elevation, 360-degree traverse, and a carriage interchangeable with the light gun. The board recommended 105-mm instead of 155-mm because it was a lighter piece that

[103]George LeR. Irwin, "Notes on the Training and Handling of Divisional Artillery in France," *The Field Artillery Journal* 9, no. 5 (November-December 1919): 504; Hero Board, 17, 37.

would have increased mobility and allow for easier ammunition transportation. Until the development of these weapons, the board recommended using a combination of French and American 75-mm guns and the French Schneider 155-mm howitzer.[104]

The Caliber Board identified the mission of corps artillery as counter-battery fire, harassing and interdicting fire, and destructive fires against strong points and logistics. All of the allied nations believed that this level of artillery needed a field gun and howitzer as well, with the exception of France, whose officers disagreed about the need for a field gun. By the end of the war, each country produced a different medium field gun, ranging in size from 105-mm (4.1-in) to 140-mm (5.5-in) and with maximum ranges from 8,700 to 19,500 yards. The board determined the ideal field gun would have between 4.7 and 5-inch diameter, ranges between 12,000 and 18,000 yards, 80-degree elevation, 360-degree traverse, and a rate-of-fire of 6 rounds-per-minute. The 4.7-5-inch caliber, in the board's opinion, could provide enough range to effect enemy artillery and enough firepower to destroy enemy fortified positions, while not overly burdening the supply system with the heavier rounds of larger calibers. Until the War Department could develop such an ideal gun, the board recommended purchasing the British 5-inch gun. The consensus of the allies was that the Schneider 155-mm was the best medium howitzer. The board recommended a 155-mm caliber howitzer with a max range of 16,000 yards, 65-degree elevation, 360-degree traverse, five rounds-per-minute rate of fire, and a carriage interchangeable with the medium field gun. With improvements in projectile design and carriage, the Schneider could fulfill all requirements. The board also concluded that anti-aircraft-artillery (AAA) was needed at the corps level. The allies

[104]Caliber Board, 9-16, 23-6.

developed a 3-inch AAA gun by the end of the war, and the board recommended that the War Department continue to develop this gun.[105]

The Caliber Board identified two missions for army artillery. The first involved interdiction, neutralization, and destruction at ranges beyond corps capabilities, while the second was providing reinforcing units to divisions and corps. The Caliber Board believed the army artillery needed a heavy field gun and howitzer, while pack artillery, trench artillery, and super guns should organize as a strategic reserve. The allies agreed that the ideal field gun should be approximately six inches in caliber, fire an approximately 100-pound projectile at ranges greater than 25,000 yards, and be capable of travel down roads without interfering with two-way traffic. The board recommended a gun modeled on the French 155-mm Grande Puissance Filloux (GPF, referring to high power, Grande Puissance, and its designer, Colonel L. J. Filloux) with improved carriage and elevation capability. The French, British, and American officers consulted by the Caliber Board believed the army needed two calibers of howitzers, approximately 8 and 9.5 inches. The board contended that an 8-inch howitzer could meet the army mission requirements and recommended it be the only piece to simplify supply; however, it recommended further study of 9.5-inch howitzers. The British 8-inch was an adequate piece, but not easily altered, so the board recommended the War Department develop a new piece. The combatants used an assortment of super-heavy guns and howitzers, many of which were coast and naval guns, mounted on railcars during the war. The Caliber Board recommended four types of super heavy guns be used in the future, an 8-inch gun firing up to 35,000 yards, a 14-inch gun firing over 40,000 yards, a 12-inch howitzer

[105]Ibid., 9-14, 16-8, 26-8, 34-5.

ranging 25,000 yards, and a 16-inch howitzer that ranged 27,000 yards. The board also recommended the reserve have AAA and 75-mm anti-tank guns.[106]

Each board came to different conclusions over the organization and equipping of trench mortars. The armies developed trench mortars to provide the infantry with a front-line indirect fire weapon that could engage the entrenched enemy. Initially, trench mortars were heavy siege weapons in fixed positions. By the end of the war, lighter, more mobile mortars replaced them, to keep pace with the attacking infantry. There were two types of trench mortars used during the war, light with calibers around 6-inches or 150-mm and medium around 9.5-inches or 240-mm. The Italians also developed a heavy 400-mm mortar that saw limited action toward the end of the war. The Caliber Board recommended further development of a 6-inch light mortar but did not address a medium caliber mortar. The Trench Mortar Board urged acquisition of the British 6-inch light mortar and the French 240-mm medium mortar. It also recommended further study of the Italian 400-mm heavy mortar. All of the boards agreed that the army should remove trench mortars from their current position in the division artillery, allowing the commander to attach them to attacking infantry units as needed. The Hero Board and Caliber Board recommended they be part of the army reserve, allowing flexibility of assignment to mass with attacking units. The Trench Mortar Board believed the army should establish a separate trench mortar organization to support armies as needed.[107]

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[106]Ibid., 10-1, 18-20, 28-38.

[107]Trench Mortar Board, 1, 9-11, 16-9, 35, 39, 88-9; Hero Board, 18, Trench Mortar Board, 37.

Ammunition was problematic during the war. The U.S. Army depended upon its allies not only for weapons, but also for ammunition. French 75-mm ammunition was highly unreliable due to defective fuses, resulting in non-detonation or detonation of the projectile while still in the cannon tube. The Caliber Board advocated the development of a multi-functional fuse, capable of operating in time, super-quick, or delayed modes, thereby simplifying supply and allowing for maximum flexibility. Critical to the development of any fuse was that it not arm until it had left the cannon tube. The Trench Mortar Board recommended that a fuse be developed that would be universal to all calibers of ammunition, also with the intent to simplify supply and maximize flexibility. The Caliber Board recommended the study and development of projectiles to achieve greater range, while the Trench Mortar Board recommended the development of gas, smoke, and incendiary shells for the light mortar. For Propellant, the Caliber Board recommended a nitro-glycerin based propellant replace the nitro-cellulose base used during the war, as it was vulnerable to moisture.[108]

Transportation was also a significant issue during the war. There was a notable shortage of horses to move the artillery, and insufficient fodder to feed the horses they had. Horses were also vulnerable to indirect fire, particularly gas shells. Industrialization in the U.S. had a major effect as well, causing a shortage of soldiers and junior officers with experience in caring for horses. An assortment of trucks and tractors augmented horses in transporting artillery, resulting in a complex and impractical supply and repair system. Artillerymen recognized that motorization was the proper course for artillery, but technology was limited at that time. Trucks, although easiest to supply and repair, were

[108]Caliber Board, 21-3; Trench Mortar Board, 11-2.

largely limited to roads for travel. Tractors were more maneuverable and could haul greater weights, but were slow and limited in production. The Hero Board recommended the immediate motorization of all medium and heavy artillery, with a tractor as the transport, and light artillery be phased towards tractor drawn motorization. The Caliber Board concurred with these findings but also recommended the army conduct studies to determine the viability of self-propelled artillery. The Lassiter Board determined that tractors provided artillery with the speed, power, and range it needed. It advised that in addition to medium and heavy artillery, the army should motorize the 155-mm and one of the 75-mm regiments of each division with tractors immediately, with the remaining 75-mm regiment converted as soon as enough equipment was available.[109]

The Boards made excellent recommendations on materiel development for the U.S. field artillery. The type and caliber of weapons designated for light, medium, and heavy units was appropriate at the end of the war. The light field gun was less than ideal due to its low angle of fire, but no howitzer could provide the high rate of fire, vital to supporting infantry divisions. The recommendations to motorize the artillery recognized the vulnerabilities of horse-drawn artillery and the advantages of motorization. The boards also properly recognized the ordnance improvements needed, in particular the need for a bore-safe fuse.

Observation of Indirect Fires

With the shift to indirect firing, the ability to observe fires and communicate with the firing unit was a critical need. Artillery requests from the infantry were problematic.

[109]Hero Board, 13-4, 27; Caliber Board, 24-47; Lassiter Board, 11-5; Irwin, "Notes on the Training and Handling of Divisional Artillery in France," 491.

Infantry officers lacked the training and understanding of artillery fires. In response, the artillery attached liaison officers to the infantry to communicate infantry needs to the artillery. However, the unreliability of communications resulted in fires often being slow and inaccurate. Although preplanned targets and rolling barrages enabled significant effects, the need for observers to communicate dynamic targets remained. The Hero Board recommended a significant increase to telephone and wire allocation for firing units. General Hines and General Snow believed improved radio communication was key and recommended that the army focus efforts in development of that technology. Aircraft provided an ideal platform for observers, as they could easily see troop movements and spy enemy fortifications. However, aerial observers did not understand the needs of artillery units and often failed to report vital information. The Hero Board suggested the Field Artillery Branch assume responsibility for aerial observation. General Hines believed aerial observers should remain part of the Air Service to keep them integrated with other flyers, but recommended a board of air service, field artillery, and infantry officers convene to develop doctrine on the role of the aerial observer. The boards accurately identified the importance of the observer but failed to correctly identify proper means of improving this capability. General Hines was more accurate in his assessment, both in recommending improvements to radio communications and increasing the relationship between the Air Service, infantry, and artillery to better codify the role of aerial observers.[110]

[110]Dastrup, *King of Battle,*168-9, 175-6; Irwin, "Notes on the Training and Handling of Divisional Artillery in France," 493, 501-2; Hero Board, 13-6, 36-7.

Training a Reserve Force

Due to the unique technical expertise required of artillerymen, particularly officers, the expansion of the army was a tremendous challenge. The artillery community recognized a need to maintain the experience from the war and build upon it in order to maintain the capability for rapid expansion of the force. General Hines saw R.O.T.C. as a key component to building and maintaining a skilled reserve of artillery officers, and he recommended expanding the program to all major universities. In order to train officers and maintain their capabilities, General Hines argues for a large ammunition allocation in peacetime. He was also critical of the lack of staff skills, recommending officers be trained in artillery staff duties at brigade, corps, and army levels. Only General Hines identified these needs. None of the boards addressed methods for effectively expanding the artillery force or the maintaining of a trained reserve.[111]

Roles of Coast and Field Artillery

A major question addressed at the end of the war was the branch organization of artillerymen. All artillerymen performed a mobile artillery mission, blurring the lines between coast and field artillery. Many coast artillery officers were concerned about the disparity in promotions. As field artillery units grew at a significant rate, field artillery officers were favored in promotions. As a result, 70-percent of coast artillery officers questioned by the Hero Board favored merging with field artillery and returning to a single artillery branch. All field artillery officers surveyed favored keeping the branches separate, citing the intricate requirements of supporting mobile infantry and cavalry. The

[111]Hero Board, 26-7.

Hero Board proposed a compromise to allow more opportunity for coast artillery officer advancement. The board recommended all anti-aircraft artillery, trench mortars, and cannons greater than 6-inches fall under coast artillery. General Hines disagreed with this solution, believing the nature of field artillery supporting infantry and cavalry required that these weapons return to field artillery responsibility. He did recommend that train-mounted artillery remain a coast artillery responsibility, as it was not capable of maneuvering on the battlefield and was deployable in support of a field army or in coastal defense. His solution for the disparity of promotions was the creation of a single promotion list disregarding branch, and the allowance of officer transfers between branches. The Trench Mortar Board had a novel idea, proposing the creation of a trench mortar branch in addition to those of coast and field artillery. The Board argued that trench mortars had a specialized mission that required specialized officers and proper representation in the War Department. Although the boards identified possible roles for the Coast and Field Artillery branches, they failed to see the shifting nature of warfare. Naval guns in World War I were already reaching ranges beyond the horizon, making coast artillery less effective. In addition, the improvements in aviation, to include the development of aircraft carriers, made the defense of the air more critical than the defense of the coastline. Coast artillery was losing its relevance in the modern army, which no artillery board identified.[112]

The United States Army invested significant effort in capturing the lessons of the A.E.F. and its artillery. A force that was ill equipped for its mission had performed admirably, but this was not a satisfactory model for future wars. The immense equipping

[112]Hero Board, 3, 7, 32-3, 78-91, 474-84; Trench Mortar Board, 13.

requirements and the technical expertise required particularly challenged the artillery. The boards recommended organization and equipping for a future war and a plan for maintaining readiness in peacetime; however, with a post-war environment in which the prevailing attitude was to avoid future war in Europe, the U.S. Army would have to implement changes under a constrained budget and with little political support.

CHAPTER 5

POST WAR CHANGES

The artillery force of the United States had entered World War I unprepared. The military leadership captured lessons learned and had a clear path for preparing for future war, but social, political, and economic conditions would make change difficult.

The idea of World War I as the war to end all wars was prevalent in the United States. No one could believe that nations would ever again be willing to face destruction and death on the levels of the Great War. Isolationism rose, as America desired avoiding another entanglement away from its shores. Americans, after learning from returning soldiers of the destructive cost of World War I, did not want the United States to become entangled in another European conflict. Many viewed Europe as aggressive and too likely to descend into conflict that could draw the United States into another war having little to do with American interests. Sentiments were so strong the Congress refused to allow the United States to enter the League of Nations, an organization championed by President Woodrow Wilson. In addition, a growing pacifism movement developed out of the testimony of returning soldiers.[113]

Materiel

Under these conditions, the Army would look to arm its artillery for the future. Founded upon the Caliber Board's recommendations, the Field Artillery branch in cooperation with the Ordnance Department first looked to improve its light artillery. Improvements in range, mobility, and traverse were the primary concerns of the Caliber

[113]Dastrup, *King of Battle,* 179.

Board. The 75-mm gun was the key divisional piece of the war. The Ordnance Department constructed and tested several 75-mm guns from 1920 to 1925. The M1923E split trail gun proved the best design, having better stability, greater elevation and traverse, and a maximum range of 14,880 yards. The Ordnance Department recommended a complete fielding of the M1923E, later redesignated the M1 75-mm. Fielding of the M1 was slow due to budget limitations and the surplus of these, and the army continued to use the French M1897, the American M1916, and the British M1917 into the 1930s. To find cheaper means of modernizing the 75-mm units, the War Department decided to improve the M1897, of which it has the largest stockpile, in the early 1930s by mounting it on a modern carriage and extending its range through improved ammunition. The M1897A4, later designated the M2 75-mm, began to be fielded in 1934. With four different 75-mm field guns, each a very different model with different capabilities, training, and fighting with a unified force was difficult.[114]

The Caliber Board also called for the replacement of the 155-mm howitzer with a 105-mm in division artillery units to improve mobility. The 155-mm could not keep pace with infantry units, as it could not travel on small roads and was too heavy to cross many bridges. Using captured German 105-mm howitzers as a models, the Ordnance Department developed and tested four 105-mm howitzers in 1920. At the same time, the Field Artillery Board, a board of artillery officers appointed by the War Department to recommend, test, and evaluate artillery improvements, tested captured German 105-mm

[114]McKenney, *Organizational History of Field Artillery,* 139-40; Dastrup, *King of Battle,* 185-6; The Field Artillery School, "Field Artillery Materiel (Weapons) 1934 Edition" (Fort Sill, OK: U.S. Army Field Artillery School, Morris Swett Technical Library Division, 1919), 168-9, 171-2, 174-5, 199-200, 207.

howitzers mounted on improved carriages. The Field Artillery Board recommended fielding the improved German 105-mm, but shortages in ammunition and in serviceable German howitzers resulted in the War Department abandoning this plan. In 1928, the Ordnance Department produced an American 105-mm howitzer mounted on a split-trail carriage, and the army designated it the M-1 105-mm howitzer. The War Department, however, could not produce enough howitzers due to limited funds, and reinstated the M1918 155-mm howitzer to division artillery. In 1930, the Field Artillery Branch produced a modified M-1 105-mm howitzer that would be cheaper to manufacture. Testing the following year proved that motor vehicles could not tow the new howitzer, designated the M-2, at high speeds and the howitzer required the digging of a recoil pit to prevent striking the ground during high angle fires. Funding again would interfere, preventing further development. As a result, the 155-mm howitzer remained in divisions in 1935. Further attempts at replacing the 155-mm did not occur as most artillerymen began to desire greater firepower at the division level. In fact, by 1935, most senior field artillery officers favored replacing the 75-mm gun with the 105-mm howitzer. The 75-mm's trajectory was too low and the shell too small to have the desired effects. Difficulty in manufacturing the 105-mm combined with the large inventory of 75-mm guns prevented this transition.[115]

The War Department also pursued modernizing medium artillery, testing 4.7-inch and 155-mm guns. Both met all test requirements. The War Department decided to produce the 155-mm gun to eliminate one caliber, thereby simplifying supply and saving

[115]McKenney, *Organizational History of Field Artillery,* 138-9, 146-8; Dastrup, *King of Battle*, 186-8; "Field Artillery Materiel, 1934," 210-13.

money; however, budget constraints delayed production and the army did not produce the gun until the late 1930s. In 1934, the army was still using its war inventory of 155-mm guns (GPF) and 155-mm M1918 howitzers, the latter being copies of the French 155-mm "Schneider" howitzer.[116]

The limited budget most stunted heavy artillery, it being the most expensive. There was universal interest in a new 8-inch howitzer, but no development occurred. The heavy artillery of 1934 was the 155-mm GPF and the French 240-mm M-1918 howitzer.[117]

Trench mortars were virtually ignored during this period. The War Department, concerned with funding, declined to establish a separate Trench Mortar Branch. Instead, it approved the findings of the Hero Board and moved trench mortars to the artillery reserve. Neither the Field Artillery nor the Coastal Artillery expressed interest in managing trench mortars. The infantry decided to purchase the British 6-inch Newton for infantry support in the 1930s. The Chemical Warfare Service also maintained mortar units to provide chemical and smoke support to the infantry. Without a champion to support them, medium and heavy trench mortars were.[118]

Although the army had ambitious goals for modernizing its artillery, testing many different guns and howitzers in the 1920s, budget cuts continually stymied development. The Air Corps also inhibited the development of heavy guns and howitzers, arguing that

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[116]Dastrup, *King of Battle*, 191; "Field Artillery Materiel, 1934," 176, 187, 190-1.

[117]"Field Artillery Materiel, 1934," 191, 195-6.

[118]Wellons, "Direct Fire to Indirect Fire," 24-5; John C. LeBlanc, "Salute to the Chemical Corps," *Soldiers* 52, no. 7 (1997): 35-6.

it could complete the harassment and interdiction missions previously belonging to the heavy artillery. Despite the budget limitations, the War Department had developed and tested several weapons that it could field in support of a future war; however, in the event of a large-scale war, the War Department would be dependent on private industry that had not developed the means to manufacture large amounts of artillery. The Field Artillery School's assessment of the situation was "It cannot be expected that this reserve will be replaced, in peace, with more modern materiel, because of the great cost involved. *Furthermore so long a time is required for production, issue, and training with new types that it is safe to assume that any war fought by the United States during this generation will be begun and continued during a considerable period with World War materiel.*"[119] The War Department and the Field Artillery branch had largely failed to develop the new cannons recommended by the Caliber Board and completely failed to develop the means to produce weapons on a large scale.

A way in which the War Department was able to improve capabilities relatively cheaply was through the improvement of projectiles. Improvements to the high explosive shell primarily focused on increasing range. By the 1930s, these improvements resulted in an increase of range of fifty percent for the 75-mm and the 155-mm shells. In addition, a bore-safe fuse capable of time, super-quick, and delay settings was developed for the high explosive shell. This design was so effective it was still in use in the Vietnam War.

[119]Italics are from the original source. "Field Artillery Materiel, 1934," 22-3; Dastrup, *King of Battle*, 186, 191-2.

The army succeeded in making the recommended improvements of the Caliber Board in both projectiles and fuses.[120]

Although the budget greatly inhibited gun and howitzer improvements, the War Department did make improvements in carriages. The Caliber Board had specified 360-degree traverse and common carriages for light, medium, and heavy weapons respectively as ideal. The War Department developed common carriages for the light and heavy weapons, but they still had not fielded them as of 1934. The light carriage had 360-degree traverse, but the heavy did not, as it was not practical due to the heavy weight of the weapons. A carriage supporting 360-degree traverse would require significant weight and a wide berth to support firing of the heavy cannons. Despite the delays to the new carriages, the Ordnance Department and the Field Artillery Board were able to make improvements to existing carriages, enabling them to provide greater stability and sustain the rigors of high-speed cross-country travel. The primary improvements were the installation of rubber tires and modern suspension systems that incorporated much of the technology of recoil mechanisms. By 1936, the War Department had improved carriages with pneumatic tires, anti-friction bearings, and springs to support rugged travel. Although the War Department succeeded in developing carriages meeting the Caliber Boards recommended specifications, with the exception of 360-degree traverse for medium weapons, it again was unable to develop the manufacturing system needed to

[120]The Command and General Staff School, *Army Extension Courses: Special Text No. 107, Division Artillery* (Fort Leavenworth, KS: The Command and General Staff School Press, 1935), 17-8; "Field Artillery Materiel, 1934," 168, 171, 174, 190, 199, 207, 212.

mass-produce these carriages. Improvements to existing carriages enabled the War Department to meet the most critical requirement of motor-transportable carriages.[121]

Artillerymen quickly accepted the possibility of motorizing to improve mobility. As early as 1902, the U.S. Army had investigated motorization of artillery, but testing proved vehicles either unsatisfactory or impractical. By 1917, the U.S. was manufacturing tractors to tow medium and heavy artillery, and converting carriages to rubber tires; however, shipping space limitations prevented full motorization of medium and heavy artillery during World War I. With the rise of motor vehicles in the 1920s, civilian horse population declined, assuring the army would need motor transportation for the bulk of its artillery. The army conducted a number of tests during the 1920s to develop motorization for their medium and heavy artillery, but by 1928, commercial tractors had developed to the point that they were fulfilling the army's needs. Tests of self-propelled artillery did not fare well. The best candidates, the Holt Mark IV and the Christie chassis, proved to be too slow, too heavy, and prone to breaking down. In addition, artillerymen were opposed to self-propelled artillery because of its large silhouette. Motorizing light artillery proved challenging as well. Most artillery officers accepted the inevitability of motorization, but saw no reason for it to occur yet. They held a bias against motor vehicles as a result of their experiences during the war, in which a makeshift fleet of cars, trucks, and tractors resulted in supply and repair nightmares. The War Department, however, pushed for testing of motor vehicles. Although tests in the early 1920s found the vehicles unsatisfactory, lacking either the speed or maneuverability required to support a division, technological advances proved promising, The War

[121]"Field Artillery Materiel, 1934," 23, 25, 50; Dastrup, *King of Battle*, 192.

Department desired to conduct additional testing, but the budget again interfered along with reluctance to purchase vehicles when they were advancing in quality so quickly. Finally, in 1928, the War Department declared that horse-drawn artillery would remain in the division for the foreseeable future.[122]

Things began to change in 1930, when Major General Harry Bishop became Chief of Field Artillery. General Bishop was a strong advocate of modernization and heavily criticized his branch's failure to embrace full motorization. In 1931, he wrote a letter to the army's Adjutant General stating, “Long continuous study, experimentation and tests have convinced this office that the prime mover problems can be solved by the use of ford vehicles.”[123] Pressured by General Bishop and the decline of the horse population in the U.S., the War Department directed the Field Artillery Board to test a 75-mm gun towing by high-speed vehicles. The board conducted tests with various vehicles from May 1932 to March 1933. Even before the tests were complete, General Bishop reported the satisfactory performance of motor transport in late 1932. At his urging, the War Department began the transition to motor transport for light artillery in 1933. It immediately motorized half of the 75-mm regiments, with plans to motorize the other half in the late 1930s. Although slow in occurring, motorization in accordance with the recommendations of the Hero and Caliber Boards was largely successful. This,

[122]McKenney, *Organizational History of Field Artillery*, 129, 133-6; Dastrup, *King of Battle*, 188-90; House, *Toward Combined Arms Warfare*, 45.

[123]Harry Bishop, “Motorization of Light Field Artillery” (Letter to Adjutant General, Fort Sill, OK: Morris Swett Library, 1923), 1.

however, had more to do with the rapid technological advances in the private sector than with the efforts of the War Department.[124]

Organization

There was significant debate over the organization of artillery units, particularly for those supporting divisions. The Field Artillery Branch supported the recommendations of the Hero Board that two light gun regiments and one light howitzer regiment organized under a brigade headquarters support each division. The War Plans Division of the War Department recommended abandoning the light howitzer regiment and keeping a brigade of two gun regiments, while General Pershing favored reducing division artillery to one regiment of 75-mm guns. Saving money by reducing manning and equipment motivated the War Plans Division. General Pershing felt the large artillery organization was too unwieldy for an open battlefield that would likely exist in North America, where he believed the next war would occur. To resolve these differences, as well as those in other branches, Secretary of War Newton D. Baker appointed a committee in 1920 to study division organization. The committee, known as the Lassiter committee, identified three options, to retain the current "square" division of 28,000 soldiers, develop a "triangular" division of three infantry regiments, or reduce the square division to 20,000 men. The committee determined that the current square division, double the size of French, English, and German divisions, was too large and unwieldy, and that the triangular division would cause too much disorder through the drastic change in organization. It decided the reduced square division would provide enough firepower

[124]McKenney, *Organizational History of Field Artillery,* 135-6; Dastrup, *King of Battle,* 191-2.

while not being too unwieldy. In the new division, the brigade of artillery would remain with the 155-mm howitzer regiment replaced by 105-mm howitzers as recommended by the Caliber Board. Chief of Staff Peyton C. March approved the committee's recommendations in August 1920, and the War Department began implementing the changes that fall. Despite the change to 105-mm howitzers in organization, the inability to produce the new cannon meant the light howitzer regiments remained 155-mm. As a result, in 1935, the organization of an infantry division's artillery brigade was still two 75-mm gun regiments and one 155-mm howitzer regiment. The organization of corps artillery did not change during this period, remaining two 155-mm howitzer regiments, one 155-mm gun regiment, and one AAA regiment. The War Department removed all heavy artillery from the field army and organized it as the General Headquarters (GHQ) Reserve Artillery with the mission to support the field force commander. The only artillery directly under field army control was one brigade containing three regiments of AAA. The organization of the artillery during the post-war period reflected the recommendations of the Hero Board, and included maintaining a field army artillery staff recommended by General Hines to support the field army commander.[125]

General March had ambitious plans for manning of the army following the war. He proposed the Regular Army maintain a strength of 500,000 organized into five half-strength corps. A reserve system organized around universal military training for all males would fill out the corps in time of war. The Senate Military Affairs Committee, conducting hearings on General March's proposal, heard testimony from Colonel John

[125]McKenney, *Organizational History of Field Artillery*, 141-3; Dastrup, *King of Battle*, 184-5; Command and General Staff School, *Special Text No. 107, Division Artillery*, 7-8.

McAuley Palmer, a trusted member of General Pershing's staff during the war. Colonel Palmer advocated a small army, using the successful mission of the A.E.F. as evidence of the ability of the citizen soldier and the non-necessity for a large standing army. Based on Palmer's testimony, Congress passed the National Defense Act of 1920, authorizing a force of 288,000, still the largest the United States had ever maintained during peacetime. The act organized the army into nine corps, each covering a different region of the United States. Each corps contained one Regular Army, two National Guard, and three Organized Reserve Divisions. Congress, however, did not appropriate enough funds to maintain this strength level. As a result, Regular Army strength was 150,000 in 1921 and continued to decrease to a strength of 118,500 in 1927. Field artillery officer strength in the Regular Army averaged seventy-percent from 1921 to 1928, with shortages being significantly higher in the firing units, as many officers were required at the Field Artillery School, ROTC, and in Washington. These manning shortages would continue into the 1930s. General Bishop in his first Annual Report as Chief of Field Artillery assessed the shortages as, “In 1931, the field artillery in the Regular Army had five skeleton brigades . . . and twenty-one regiments. Some regiments were down to two firing batteries, and even the batteries were below strength.” The National Guard struggled as well, with its strength often below fifty-percent. In 1927, only sixty-percent of National Guard field artillery units were manned, the other forty-percent existing only on paper. The Organized Reserve suffered the worst shortages. Field artillery officers only accounted for sixty-percent of the stated goal of 20,000 in 1921, and the numbers steadily decreased, as ROTC could not replace the losses of World War I veterans. In the early 1930s, the manning situation started to improve for the field artillery. The motorization

program increased the number of personnel assigned to support the program and freed soldiers from stable duties to fill gun positions. As a result, by September 1935, there were 100 firing batteries manned, more than double the number in 1931. Although the organization on paper reflected the recommendations of the Hero Board, the critical shortages of personnel resulted in skeleton organizations. The army would have been better served to maintain a smaller number of artillery regiments at or near 100-percent strength to enable the training needed.[126]

The War Department addressed the question of whether Coast and Field Artillery branches should remain separate in 1919, when it convened a board under Major General Joseph T. Dickman to determine their missions in light of wartime experiences. The Dickman Board believed that motor transport enabled even the heaviest artillery pieces mobility, thereby blurring the lines between the two branches. As such, the board determined that harbor defense should become a naval responsibility, and heavy artillery should fall under the responsibility of the field artillery, ending the Coastal Artillery Branch. In response, Major General Frank Coe, Chief of Coastal Artillery, recommended that Coast and Field Artillery Branches merge. The National Defense Act of 1920, however, kept the branches separate and kept harbor defense as the responsibility of the coast artillery. Officers began discussing consolidation again in 1927, causing the War Department to define each branch's mission clearly in General Order 22. Field Artillery Branch was to support combat arms on the mobile battlefield with pack, division, corps,

[126]McKenney, *Organizational History of Field Artillery*, 125-6, 144-5; Dastrup, *King of Battle*, 179-80; War Department, *Annual Report of the Chief of Field Artillery, Fiscal Year 1930* (Washington, DC: Government Printing Office, 1930), 18; War Department, *Annual Report of the Chief of Field Artillery, Fiscal Year 1934* (Washington, DC: Government Printing Office, 1934), 2.

and GHQ reserve artillery, except in the cases of AAA and railway artillery. Coastal Artillery Branch defended the harbors, manned railway artillery, and fully assumed the AAA mission. As had the boards, the post-war army failed to deal with the changing nature of warfare in the branch organization of artillerymen. Coast defense had a diminishing role that could have been better served by integrating into the navy as the Dickman Board recommended. The AAA mission was a unique and rapidly growing need that would soon deserve its own branch, but not in 1935. The reasons for Coast and Field Artillery branches so recently having separated was no longer relevant, as improvements in maneuverability transported the heavy guns of coast defense into the field.[127]

Building on the lessons of the war, the army established flash and sound ranging units to provide accurate means of counter-battery fires. Starting with one battery in 1922, the army eventually built up to two battalions in 1940, with a total of six batteries. The battalions were integrated into the GHQ, with the ability to attach platoons to corps. Although an important tool in the counter-battery fight, the boards failed to mention flash and sound ranging. Fortunately, the army continued to develop this technology despite the oversight of the boards.[128]

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[127]Boyd Dastrup, "A Brief History of the FA and ADA," *Fires* (January-February 2008): 8-9; McKenney, *Organizational History of Field Artillery*, 125-6; Dastrup, *King of Battle*, 179-80.

[128]McKenney, *Organizational History of Field Artillery*, 150.

Doctrine

The Field Artillery Branch and the War Department worked together to update doctrine to reflect the changes in artillery employment. *Field Service Regulations, United States Army 1923 (FSR 1923)* updated the army's tactical doctrine. It focused heavily on artillery, codifying division, corps and GHQ artillery and their missions. Division artillery's mission was direct support of the infantry, while corps artillery was responsible for counter-battery fires and AAA. The GHQ artillery's responsibilities were attack of heavy fortifications, interdiction and destruction fires, reinforcing divisions and corps, and AAA. *FSR 1923* for the first time defined the artillery roles of direct support and general support. Because of the difficulties of division artillery to keep pace with the breakthrough during the war, *FSR 1923* specified that engineers should be attached to artillery units to facilitate mobility in the pursuit. *FSR 1923* also detailed movement of artillery, dictating that artillery should move to forward positions by battalion (battery for cavalry units), maintaining at least one battalion per regiment ready to fire at all times. On the question of control of aerial observers, it stated, “Observation airplanes assigned to artillery missions operate under the direction of the artillery commander.” This worked to resolve the problems of aerial observer support seen during the war.[129]

Tactical Employment of Field Artillery, 1924 (TEFA, 1924) updated artillery tactics to account for changes related to the war as well as the modern mobile battlefield. It defined the three basic types of fires as destruction, neutralization, and fires for moral effect. It then went on to describe different methods of fire as accompanying fire, artillery

[129]War Department, *Field Service Regulations, United States Army 1923* (Washington, DC: Government Printing Office, 1923), 15-7, 35, 45, 83-4, 93, 99-100.

preparation, counter-preparation, counter-battery, interdiction, harassing fire, barrage, concentration fires on fortifications, and fires against tanks. It also described the missions of artillery in offensive and defensive operations, but did not include much detail, most likely a reflection of the argument at that time amongst artillerymen of whether mobile battle or the static battle of World War I should be the focus of artillery moving forward. *TEFA 1924* addressed the duty position of observer for the first time, separating it from the role of liaison; however, it did not address the role in significant detail, other than that of the aerial observer. Instead, it focused significantly on the role of intelligence to provide artillery units with pre-planned targets. It assigned liaisons with the responsibility of providing the artillery unit with the current situation of the supported artillery unit, to include any changes in mission. *TEFA 1924* also addressed for the first time signal communications. It focused primarily on telephone communications, stating that units should only use radio communications with aerial observers. It gave significant attention to other means, such as signal flags, panels, pyrotechnics, and messengers, showing both the unreliability of wire communications and the bias against radio. It also gave significant attention to ammunition supply and management, reflecting the tremendous ammunition expenditure of the war.[130]

Tactical Employment of Field Artillery (Tentative), 1935 (TEFA 1935) contained significant changes from the 1924 version. It listed the same types and methods of fire but in greater detail. It also detailed artillery offensive and defensive operations, now detailing both mobile and static battlefields. With the increased focus on a mobile

[130]War Department, *Tactical Employment of Field Artillery* (Washington, DC: Government Printing Office, 1924), 7-16, 30, 33-49, 50-52, 84-9.

battlefield, *TEFA 1935* covered the process of position selection in detail, with range, terrain, protection and concealment, and signal communications all considerations for selection. It also detailed the observation plan, with a layered observation in which ground observers were responsible for close targets and aerial observers responsible for deep targets. *TEFA 1935* also codified the composition and roles of unit staff from battalion to brigade. Most significantly, it included the Fire Direction Center (FDC) for the first time. The FDC developed from 1929-33 through the efforts of the Field Artillery School. The school staff, led by Major Carlos Brewer, believed that the coordination of fires during the war were unacceptable and made efforts to fully develop a system for coordinating massed fires from multiple units controlled by a single observer. To accomplish this, a coordination element within the artillery staff needed to be capable of computing firing data for multiple units. In 1929, Major Brewer and his staff developed a way of establishing a firing chart that could determine firing data for multiple units. By 1930, the section had also developed the ability to correct for errors in survey by transferring the data from one gun to others; however, Major Brewer discovered that these corrections failed to achieve accuracy when transferred from one battery to another. Extensive study determined that differences in altitude of the batteries caused the error; as a result, the school developed computations to correct for this difference, referred to as site. By 1933, a fully functional FDC, managed by the battalion operations officer, was established, and it was included in *TEFA 1935*. The role of liaison officers was further detailed in TEFA 1935, with artillery-to-artillery liaison now mentioned for reinforcing units from the GHQ. It also specified that the brigade commander of the division artillery should be located on the battlefield with the division commander to provide the brigade

with an understanding of the division commander's intent. Signal communications was again covered, but in less detail. It still indicated that telephone was the primary method of communications on the ground but included radio communications as a secondary form of communications. The Signal School in conjunction with the Field Artillery School issued a pamphlet in 1923 that served as the primary guidance for artillery communications. It stated, "The main dependence for field artillery signal communication (except with airplanes) is placed upon the telephone; that is, the wire system." Shortages of radios, susceptibility to intercept, unreliability, and prejudices stemming from the problems of radio use during the war influenced this stance. It did list radio as a secondary means of communication. The Signal School pamphlet also detailed the duties of the battalion communications officer as commander of the headquarters battery, establishment and maintenance of battalion communications, establishment of a message center, and supervision of the care and maintenance of signal equipment. Ammunition supply received significantly less attention in *TEFA 1935*, a reflection of improvements in fire direction and ammunition quality reducing the ammunition requirements on targets.[131]

The War Department and the Field Artillery branch effectively captured the lessons of the war along with those learned after the war in their doctrine. *FSR 1923* effectively detailed the role of artillery in combat. It also defined the role of the aerial

[131]The Command and General Staff School, *Tactical Employment of Field Artillery (Tenetative) 1935* (Fort Leavenworth, KS: The Command and General Staff School Press, 1935), 7-16, 30-49, 50-52, A6-13; Signal School, The Signal School, "Signal School Pamphlet No. SS-31, Signal Communication for Field Artillery (Provisional)" (Fort Sill, OK: U.S. Army Field Artillery School Morris Swett Technical Library Division, 1923), 20, 36-8, 99-100; McKenney, *Organizational History of Field Artillery*, 150-2.

observer and how he would be managed in combat, alleviating the issues that occurred during World War I. *TEFA 1924* updated field artillery doctrine to reflect its role at the end of 1918, defining the role of the observer and addressing signal communications. *TEFA 1935* further detailed artillery defensive and offensive tactics, updated communications to account for technological advances, and documented the role of the FDC as developed by Major Brewer and the Field Artillery School staff.

Training

Training the artillery force would face the same struggles with economy. After the war, field artillery officer training was decentralized with the Basic Course at Camp Knox, KY, the Battery Officers' Course at Fort Sill, and the Field Officers' Course at Camp Bragg, NC. With the passing of the National Defense Act of 1920, The School of Fire was redesignated the Field Artillery School. The War Department felt that the current military education system was too cumbersome and expensive, and decided to consolidate the courses at one location in 1922. It believed Fort Sill was too small and underdeveloped. Camp Knox and Camp Bragg were overcrowded and lacked artillery range space. In the end, the War Department selected Fort Sill because of its ample artillery range space, but considered it a temporary solution until it could establish a better site. The permanent home of the Field Artillery School remained in question until December 1930, when the War Department designated Fort Sill to fill that role. With questions of relocating, the school received little funding during the 1920s, resulting in shortages of supplies and equipment. In 1926, Chief of Field Artillery Snow included in his annual report that shortages in gasoline prevented the school from conducting aerial observer training. Shortages in manning also inhibited the school, with it often difficult to

provide even a battery for training. Although the school's policy was to maintain firing units at one-hundred percent strength to provide a training location for all artillerymen, in reality, batteries were using cooks and drivers as cannoneers. To alleviate these shortages, the school consolidated its three regiments into one in 1921. However, shortages in manning and funding would continue to disrupt training.[132]

The Reserve Officer Training Corps, established in 1916 to provide reserve officers in wartime, was not immune to the budget. By 1919, the Field Artillery Branch had organized a formal four-year artillery ROTC program, designed to have three hours of training per day, divided equally between artillery and military functions. However, budget shortfalls prevented hands-on training at most schools. Personnel shortages prohibited General Snow from achieving his goal of artillery ROTC programs at every major university. In 1919, only twenty-two universities had artillery programs.[133]

The Field Artillery branch failed in training its units for a future large-scale war. Shortages in manning, non-uniformity of equipment, and lack of funding prevented training at the level needed. Any training above the battery level was rare. In addition, the ROTC program failed to train enough officers to replace the losses in the ready reserve and lacked the depth of training needed to prepare officers properly. If the U.S. entered into a major war in 1935, it would not be unrealistic to expect it to take the same time as it did in World War I to train its force.

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[132]Boyd Dastrup, "History of the US Army Field Artillery School from birth to the eve of World War II," *Fires* (January-February 2011): 9; McKenney, *Organizational History of Field Artillery*, 149.

[133]Walters, "Field Artillery in American Colleges," 545-7, 549.

The Field Artillery branch set a number of ambitious goals following World War I, but budgetary constraints stemming from a movement towards isolationism and economic struggles largely inhibited it. The most important accomplishment was codifying a current and applicable artillery doctrine. U.S. artillery doctrine prior to the war failed to make the transition to indirect fire, and the military merely translated tactical guidelines developed by the French during the war. Improvements in projectiles were a significant and economical achievement. The army made substantial progress in motor transportation despite long delays due to economic shortfalls and institutional bias of most artillery officers; however, the field artillery had failed to motorize all of its units, a clear requirement for supporting maneuver in the increasingly mobile battlefield. Although the army conducted significant testing of cannons immediately following the war, the funding quickly disappeared and it fielded no new field artillery pieces had by 1935. The large inventory of war stock ensured that the army could at least be equipped in the event of war. Still, manning shortages made it difficult for units to conduct training at a high level.

CHAPTER 6

CONCLUSIONS

Conclusions

The field artillery of the United States Army had failed to train and equip its field artillery force prior to World War I due to conditions of isolationism and budgetary constraint. The small professional army that existed prior to the buildup to war had a new and effective artillery piece, but had little ability to train with it. There were no means of equipping the large conscript army that was raised to fight the war. As a result, the United States was completely dependent upon its allies to train and equip its artillery force for the war. Realizing its failures in preparing for war, the army commissioned a series of officer boards to determine lessons from the war and how to prepare properly for a future war of that scale. The boards, along with input from artillery leadership, collectively captured a plan for future preparedness. The army, however, would face similar conditions of isolationism and budgetary constraint as they did prior to the war, circumstances they should have fully expected. They were unable to overcome these conditions effectively, and as a result, by 1935, the United States Army had largely failed to equip, organize, and train its artillery for a future war on the scale of World War I.

The four artillery boards convened following the war accurately captured the lessons of the war and identified a plan to reform the artillery force following the war. They successfully gathered officers with expertise on artillery usage during the war and gathered detailed information from key officers of the United States Army and its allies in the war. The boards then used this information to form recommendations for the army, and the Field Artillery branch in particular, to use in its post-war modernization program.

The War Department exited the war with a focus on testing a large assortment of artillery pieces to identify the best qualities of each and develop the highest quality of artillery. Although it conducted tests on light guns and howitzers as well as medium guns, it never completed tests on large caliber weapons. With the testing, the Ordnance Department had specifications for ideal models of 75-mm gun, 105-mm howitzer, and 155-mm gun, and was able to design and produce the 75-mm gun and 105-mm howitzer. Both the gun and howitzer performed well in testing and the War Department approved them for production and fielding, but the limited budget prevented the production of those models, leaving the artillery with World War I inventory sixteen years after the completion of the war.

A greater failure was not developing a system for producing large quantities of artillery to equip a conscription army. A.E.F. Chief of Artillery Major General Hinds assessed the problem when he stated:

> One of the great lessons that our people should learn from this war is that it requires much time to manufacture guns. On November 11, 1918, with the exception of twenty-four 8-inch howitzers . . . , there was not in the firing line a single field or heavy artillery gun manufactured for us in the United States after entrance into the war - a period of 19 months. Had it not been for the matériel furnished us by the French and the British, it is believed that the war would have been lost.[134]

Despite this warning, the War Department continued to produce artillery through the Ordnance Department at small army arsenals. This measure prohibited the development of civilian industry in the arms, which the army would need to produce guns and howitzers in numbers necessary to equip a large army.

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[134]War Department, *Annual Reports, 1919*, 5220-1.

The field artillery largely succeeded at motorizing its force. This was despite significant prejudices of artillery officers and the always tight budget. All medium and heavy artillery were equipped with civilian produced tractors that could effectively transport the guns on the battlefield. Light guns were finally undergoing motorization in the 1930s due to the efforts of Chief of Field Artillery Bishop. If not for his effort, light gun regiments would likely have remained horse-drawn for many more years. With civilian industry providing transport vehicles, the army would be able to equip a conscript force.

Ammunition was one of the most successful areas of modernization. The Ordnance Department in conjunction with the Field Artillery Branch continue to improve upon the munitions, developing high explosive shells capable of ranges fifty percent greater than end of war stock and developing a single multi-function fuse that was reliable and safe, unlike the time fuses produced by France during the war.

Organization of the artillery force was partially resolved in an appropriate and effective manner. The questions of the responsibilities of the Coast and Field Artillery Branches as well as the continued separation of these branches were answered, but the problems that led to those questions were not addressed. In addition to its traditional mission of defending the harbors, coast artillery assumed anti aircraft artillery and railway artillery, while field artillery had responsibility for all light, medium, and heavy artillery pieces. This did not address the changing roles in artillery, but merely set arbitrary lines between the two branches. Coast defense was declining in importance with the improvements to ship guns and the development of aviation, and was given additional

responsibilities outside of its true mission instead of determining whether it still needed to exist as a separate branch.

The organization of the artillery force into division, corps, and GHQ reserve provided support for each maneuver organization, while giving flexibility to surge artillery on the battlefield. The deficiencies came in manning these units. Congress failed to provide the funding necessary to maintain the force at full strength levels. As a result, many field artillery units operated at strength levels that made training at the regiment and brigade level extremely difficult. Choosing to fill some unit at full strength while inactivating others would have allowed units to train at all levels. The War Department could then reactivate units in times of need, with the experienced officers and non-commissioned officers spread across the organization to provide experience and leadership to the new recruits. This failure to work in World War I was due to the tremendous size of expansion, not the method or redistributing officers and enlisted personnel. The decision to man all the units partially greatly inhibited staff training.

Doctrine changes accurately captured the role of artillery at the end of World War I and accounted for changes resulting from technological advances in the post-war period. *Field Service Regulation, United States Army, 1923* captured the role of artillery in what would become combined arms warfare, with a proper balance to mobile and trench warfare. It also detailed the role of the aerial observer, mitigating the issues that had occurred during the war. *Tactical Employment of Field Artillery, 1924* established the fundamentals of artillery in support of maneuver, while the 1935 version detailed the role of artillery at all levels. The most important addition to these manuals was the establishment of designated forward observers whose responsibility it was to identify

targets and transmit their locations to guns. *FSR 1935* took the extremely important step of establishing the fire direction center, establishing the ability to compute firing data for multiple units on a single target. With the development of observers and the FDC, the modern system of mission processing was established, allowing artillery to mass on targets of opportunity, greatly increasing effects and responsiveness to the needs of maneuver. *Signal School Pamphlet No. SS-31* provided guidance for signal operations in support of artillery. It specified the details of how to establish signal communications from the observer to battalion, regiment, or brigade headquarters, and from the regimental headquarters down to the battalions and batteries. Although wire communications was still the preferred method, the pamphlet did detail methods for radio communications.

Training in the post-war artillery force was largely a failure. The Field Artillery School was established at Fort Sill, OK, with training for lieutenants, captains and majors, but with its unsettled existence until 1930, funding and manning shortages inhibited effective training. Manning shortages equally affected training in units. Maintaining training for majors at Fort Sill was a significant success. General Hines had stated officer training in artillery staff duties was critical, and this course provided critical staff training to the officers that attended.

Although the post-war boards established a viable framework for the artillery, the Field Artillery Branch was largely unsuccessful in accomplishing the modernization of artillery materiel recommended by the Caliber Board. Sixteen years after the war, the entire artillery force was still equipped with World War I cannons. Motorization and improvements in munitions did much to mitigate this, but the failure to develop artillery

production through civilian industry ensured that equipping a large conscription force would be extremely difficult. The reorganization of artillery units was effective, developing a flexible artillery force without the great disorder that would manifest with drastic restructuring. Manning shortages, however, greatly diminished the effectiveness of the new organization. The doctrinal changes made after the war were highly successful, particularly the development of the observer, FDC, gun line structure of mission processing. Training was largely unsatisfactory during this period. Although the Field Artillery School was established with the three levels of officer training, manning and funding shortages greatly reduced their effectiveness. The post-war field artillery failed to prepare itself for a future large-scale war. If World War II had begun in 1935, the United States Field Artillery would not have performed effectively in the war.

Areas for Future Research and Considerations

Although the War Department failed to produce new cannons in the sixteen years after the war, it had a large war stock to draw upon in a time of emergency. Further investigation on the success or failure of the War Department to maintain that excess war stock is warranted. Although this study included the thoughts and opinions of select artillery officers on the proper organization, equipping, and training of the artillery force after the war, further investigation into the opinions of the entire senior officer corps of artillerymen, ordnance, and infantry backgrounds would be valuable. The development of the observer and the FDC, and how they interact in fire mission processing was touched on briefly in the thesis; further study of how this system developed, the successes and failures as it developed, and the support or resistance of artillery leadership during the development would be a very interesting focus for further study.

Relevance

World War I was a period of dramatic growth in the United States Army followed by an equally dramatic reduction. The effects of this growth and reduction were most dramatic in the field artillery. Today's army has seen a much less extensive growth, but likewise is entering a period of reduction. As we progress to a period of force reduction combined with constrained budgets, we will face a difficult process to keep our force trained, equipped and organized to face the next conflict against an enemy yet to be determined. Study of the World War I period with a particular focus on the post-war years is valuable to better understand the difficulties the army will face in the upcoming years and how to minimize the effects. The artillery boards were an effective method for capturing the lessons of the war. Although immense amounts of information have been collected on the wars in Iraq and Afghanistan and the Center for Army Lessons Learned has captured many lessons of the war, no formal method has been used by the Field Artillery branch. Artillery doctrine has been updated multiple times without that vital input. Following the example of the post World War I boards to capture artillery lessons from the past thirteen years of combat and needed changes for the future would enable the development of a more effective future artillery force.

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